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EDITORIAL NOTES—GAS, &c.

The Gas Acts for 1906.

PERSEVERING as the chronicler of events connected with Private Bill Legislation may be, it is not until the Acts are printed and procurable that he can be sure he has exhausted the interest therein of the session concerned. It is said of the policeman who rarely has charges to make, and whose "beat" is free of complaint, that his activity is worthy of the highest commendation and reward that it is within the power of those in authority to confer. There is, it may be respectfully submitted, an analogy here to the duties and responsibilities of the consulting engineer. When a company or corporation apply to Parliament for statutory powers, new or additional, and there is opposition, the consulting engineer who is able to conciliate the opponents without harming his clients is also worthy of the highest commendation and reward. The money saved by averting a contest in the parliamentary committee-rooms is, as a rule, a consideration of importance, besides which from a contest a defending company or corporation rarely escapes without loss or concession of some kind. It is, of course, not always in the power of those consulted to bring differences within the bounds of composing reasonableness; but it is very often. And those consulting engineers who can do this, who can save expense, who can prevent breaches in amicable relationships, fulfil their duties and responsibilities in the best sense. This has been so much recognized of late that, though most Bills start their indefinite career as opposed measures, few there are that have actually come before Select Committees; but it is not always possible during the session—why, we do not know—to get information as to what has been done in effecting settlement. The negotiations are conducted in all manner of places—at local offices or at those of the parliamentary agents or the consulting engineers, or at other convenient resorts in Westminster, or within the precincts of the House itself; and until there is final agreement, very properly secrecy is maintained. Afterwards, however, there can be no occasion for privacy. The time comes when the Act itself is available; and then comparison with the original Bill proclaims all change.

In this issue is begun the publication of a review of the Acts of the past session. Some of them are voluminous, merely from the incorporation of numerous stereotyped clauses that ought long ago to have found place in a General Act, and included in Special Acts by reference; and, therefore, only those clauses having an individuality, or clauses which illustrate matters of current interest, are dealt with in the review. The first three Acts noticed allude to Companies that have now become incorporated and invested with statutory powers. It is a small representation of such Companies—smaller than the number of Bills in this group with which the session started, for then there were five measures to notice. The Llandrindod Wells measure was not proceeded with; and the promoters of the Mid-Oxfordshire Gas Company failed to convince the Unopposed Bills Committee of the House of Commons that their finance was intelligible, of an enlightened character, and such that amply defended the public interests. This is now old history; but its repetition does no harm. It serves to assure future promoters of Bills that, although their plans and requests may not be opposed, the Unopposed Bills Committee will show a disposition to understand them in a most thorough manner.

In the three remaining Acts are reflected the concessions made to avoid parliamentary struggles. The capital applied for has been curtailed, and proposed standard prices reduced —somewhat considerably in cases. Certain singular clauses also appear. The Crediton Gas Company, for example, have pledged themselves to limit their dividend to 5 per cent. in any half year, unless the charge for gas in that period has been less than 4s. 6d. per 1000 cubic feet. The object doubtless is to assure that nothing in the nature of large dividends shall be paid while the price of gas is high. It is a curious attempted diversion of the sliding-scale, which a price of 4s. 5d. would restore to full action; for at that price, if the profits allowed, £10 2s. 6d. and £7 1s. 9d. per cent. could be paid on the respective classes of capital. The clause does not strike us as being notable for its cleverness; and the Company ought not to have any great difficulty in assuring that it remains a dead-letter. The protecting hand of the local authority is seen in the Dowlais Gas Act. For instance, appended to the usual form of clause providing for the carrying forward of any excess profit is the condition limiting the total undivided profits to an amount equal to 6d. per 1000 cubic feet. A special clause is also inserted, ensuring that the price of gas for public lighting is never to exceed 3s. 3d. per 1000 cubic feet.

In the matter of testing gas, it is made abundantly plain by the Acts before us that promoters whose measures deal in any way with illuminating power will save subsequent amendment by adopting straightway in their draft Bill the model testing clause, with (if desired) any variation of it that it is believed will meet with the approval of Parliament. The clause was inserted in the Provisional Orders of the session; and all the Acts so far examined that set out with the old clause specifying the No. 1 "London" argand, with variations in its method of use, have been rejected in favour of the new provision. The Dowlais Gas Company, however, have not taken advantage of the wide terms of the model clause, but have bound themselves explicitly to the "methods " and rules . . . for the time being prescribed for test- " ing the illuminating power of gas under the provisions of " the London Gas Act, 1905." The stringency of two or three sessions in the chaining of companies to definite limits in discounts has not, it is a pleasure to see, been persistently followed. In the Crediton Bill, liberty was sought in respect of large consumptions; but the 10 per cent. for prompt payment and 15 per cent. for large consumptions that had become the rule, now appear in the Act. In the Ascot Act, however, the respective limits are 10 and 20 per cent.; while in the Truro Act 25 per cent. is allowed for prompt payment, but for large consumptions, gas supplied by contract or for motive power, rebates may be granted to any extent, subject to the conditions prescribed in the special contract. Under these circumstances, we cannot see the utility of defining discounts at all, although the provision now imposed, that discounts shall be the same under like circumstances to all consumers, might still be insisted upon. Among some other notable features are the increasing number of Companies who are taking power to pay interim dividends without calling the shareholders together; the prospect being annual meetings only. The Truro Company have obtained authority to have a dual system of supply—13-candle gas for ordinary purposes, and power gas for industrial use. In the Truro Act a seven years' purchase clause has been inserted. Such long periods of uncertainty are not, we still maintain, in the best interests of an undertaking or the consumers. The electricity powers of the Ascot and Brixham Companies are a feature of the Acts noticed this week.

Touching upon the question of stand-by supplies, in the Ascot Gas and Electricity Company's Act appears a clause which disentitles any person having a separate supply of electricity to demand of the Company a supply of electrical energy, unless he agrees to pay them a minimum annual sum sufficient to give a reasonable return on the capital expenditure and other standing charges incurred by the Company to meet the possible maximum demand of such person. It is a provision of this character that is required by gas undertakings in connection with stand-by supplies of gas where producer and suction-gas plants are installed, with the extension that the user of such producer or suction-plant gas is not to be entitled to demand a supply if it cannot be afforded without detriment to the ordinary and regular consumers, nor without, if need be, a certain notice.

A Comprehensive Address.

THERE were no technical proceedings at the meeting of the North of England Association on Saturday other than the presidential address. The presidential address sufficed. It was a composition that breathed progress, success, and encouragement; and a thinker upon, and student of, the business of the gas industry was its author. When one considers of what this business is composed, the immensity of the range is somewhat startling. But out of it the author of Saturday's address picked for topic some of the choicest material. Twenty-one years ago, Mr. W. Hardie was the President of the Association; and the members in that year met, as they met last Saturday, in the city of Newcastle. It was the son, Mr. T. Hardie, however, who presided on this occasion. Seven years ago, the Chief Engineer of the highly prosperous Company with whom Mr. Hardie is identified—Mr. Doig Gibb—occupied the chair. These facts naturally led the new President into retrospection; and with such a subject as the gas industry, an exercise of the kind cannot fail to be highly interesting and most encouraging. "What "a change," said Mr. Hardie *père*, in a reference to some of the older representatives of the gas industry present at the meeting 21 years ago, "has come over gas manufacture since "these gentlemen first became acquainted with it." What would Mr. Hardie *père* have said if he had been spared to have heard from the lips of his son of the even more remarkable progress that has been made in all directions during the years that have flown since he penned the words quoted above. Strenuous have been those years for the officials of the industry; but wonderful has been the progress. Many questions have the same interest now as they had in 1885. But the gas industry is subject to the same mutability as all other mundane things. Conditions have changed; and the questions of interest have multiplied accordingly.

Take the one point of competition. It is fiercer to-day than it has ever been in the annals of the gas industry, and no Company outside London has had to meet the brunt of private electrical enterprise with greater firmness and energy than has the important one at Newcastle-upon-Tyne. But the Company, the President tells us, and the records show, is stronger to-day than ever it was. The same tale runs through the gas industry. We are pleased to see in this connection the tribute paid by the President to the manufacturers of the means of utilizing gas for the part they have taken in producing increased efficiency for the gas consumed. There is a proneness to pat oneself heartily on the back for what has been done in giving consumers cheaper gas. But cheaper gas and wasteful appliances would be ill-mated companions for producing progress and prosperity against the competition of the times. Economical appliances have, in fact, done as much as cheap gas to make the road easy to the eminence that the industry at present occupies in the public service; and they have, therefore, contributed to that condition of things which enables the President now to endorse what his father said in 1885, that "the electric "light need not disturb our equanimity," albeit it is as true now as it was when declared by Mr. Doig Gibb seven years ago, that "the struggle in the future will be even more "severe than it has been in the past."

In the retrospection that the President made, next to the general material prosperity enjoyed by the industry falls the greater efficiency that has been produced in the manufacturing operations of a gas-works—particularly in the retort-house. The present is a strong base in our manufacturing operations; and it is because of this that progress can now only be made at slow pace, and small improvements must be thankfully received. It is because of this, too, that the vertical retort has such a difficult task; and, on balancing advantages and disadvantages, any advance that is claimed must be definite and tangible before it can be acceptable. The President summed up the position of carbonization, and stated the case for and against mechanical operation, with cognition and freedom from bias. The disadvantages (of course, always supposing that the machinery has a payable amount of work to do) that he could marshal against stoking machinery were but few; and those disadvantages present an insignificant front to the statement that, at the Redheugh works of the Newcastle and Gateshead Gas Company, by the introduction of stoking machinery, "no less a "sum than £12,000 is saved annually, and not only so, but, "by the same means, the output of the retort-house has "been increased by 20 per cent." For all the types of stoking machinery—the West and the De Brouwer are mentioned—with which the President has had experience, he has a good word; but there is just a little danger, though Mr. Hardie was clearly anxious that no mistake should be made, that the cursory reader of his remarks on the De Brouwer system of charging and pushing may be impressed with the idea that there is some radical fault in the pusher. On the contrary, the pusher is all right; and it makes less breeze than is the case in ordinary drawing. It is the fault of the work upon which it is put, and not of the pusher itself, if the latter does not efficiently perform its functions. Then inefficiency being the fault of the work, we get back to the projector; and as the projector is able to do almost anything that the practised attendant chooses, any difficulties must be placed to inexperience or carelessness. The President admits that the trouble he has in mind is largely due to the inexperience of the men. This being the case, time will be the corrector; and the intelligent operator will not be long before he shows that he can deal equally as well with rough coal as with dust. By the machine, we have seen uniform layers of various sized coal deposited in retorts, and have seen the retorts discharged without a hitch. It can be done; and the only reason it is not done in cases is the one advanced by the President, which is summed up by him in the single word "inexperience." But with all machinery, during its initial years of application, difficulty has been, and will continue to be, found; and had Newcastle been among the first to adopt certain other forms of stoking machinery, trouble of other, but equally influential, kind would possibly have been experienced.

But in connection with this application of machinery in gas-works, and the adoption of other innovations, the President (who had just been announcing a trial of outside producers at the Redheugh works) uttered a little caution against being enticed into making comprehensive alterations or extensions merely through learning by figures as to the wonderful saving that has been effected elsewhere, without fully and very carefully inquiring into the antecedents, with which comparison is made, of that exceptional working, and (in looking at the advantages) into whether there are not concomitant losses with which acquaintance should be also made. We hope there is little necessity for these monitory words among gas engineers. It is part of their duty and also their responsibility to freely apply the touchstone to all the information that comes before them. If there is a tendency "to expend large amounts on plant and machinery on which "a satisfactory return is very problematical," we have so far failed to find the omens in the annual or half-yearly accounts that come before us; and it is there that we should expect to see them. However, the President, in his scrutiny of the technical work spread before him, has seen the possibility of danger, and has accordingly sounded a warning note. Just before he did so, however, these words were heard: "On the face of it, it would appear that it would be "advantageous for a gas company, situated in a coking-"coal district, to work on the coke-oven system, as under "such circumstances the additional revenue from gas sold "should enable a very handsome profit to be made." It may be suggested to the President that he should penetrate a little deeper into the results of American practice in this direction; and then he may be induced to reverse his impression, and to sound a still louder note of caution.

In another part of the address, the President laid bare the utterly misleading method of stating the working expense of suction-gas plants, by quoting only the cost incurred per brake horse power for fuel. He finds omissions that make it necessary to about double the cost quoted per brake horse power for fuel before making comparison with the cost per brake horse power for gas only of an engine running on town's gas. The figures are set forth in the address. In another quarter, we are told that some of the figures cited for fuel only for plants that are run on anthracite are no longer applicable, in view of the increase in price of the "pea" and "bean" classes of that fuel. But from another direction we now learn that satisfaction is being obtained from plant working on gas-works coke. From yet another source there is information of erratic engine working, owing, it is supposed, to the irregularity of the quality of the gas produced. There has been some difficulty in making a continuous examination of suction-plant gas, owing to the absolute governing of the engine over the operation of production, and its absorption of the gas as made. But by a recently devised method, withdrawal of samples of the gas can now be made representing exactly that which the engine is using

By the aid of this arrangement, we may ere long learn more regarding the inequality of suction-plant gas.

Turning once more to the retrospective side of the address, it is curious to observe that the father of the President, in his address in 1885, referred to the attempts made the previous year to bring the District Associations into closer relationship with the Gas Institute, and to the fact that the Newcastle Company were fined £10 a few months before for having a modest number of grains of sulphur in their gas in excess of what the Act of Parliament allowed, the absurdity of which proceeding was then exposed. The modern pages of history record affiliation, and the ruling from the statute-book of the preposterous enactment of which Mr. W. Hardie complained. The opinion expressed in our opening remarks may be reiterated in conclusion—it was an excellent address to which the members of the North of England Association listened on Saturday.

Electricity in Gas-Works.

THE discussion which took place at the last meeting of the Institution of Gas Engineers on Mr. Edward Allen's paper on the Fiddes-Aldridge machine, which also introduced the subject of the use of electricity for driving retort-house machinery, as well as the interest that had been previously taken in articles on the question published in the "JOURNAL," all indicated that the present was a favourable time to induce Mr. Charles F. Botley to give his professional colleagues of his electrical experience at the Hastings Gas Company's works. We have been fortunate in succeeding —fortunate because we do not think there is a gas engineer in the country who has had a longer or greater experience in the generation, by independent plant, of electricity specially for the purposes of a gas-works. Of course, there are a few municipal gas engineers whose professional work has embraced the charge of the electricity undertaking; but that is not at all the same thing. The articles by Mr. Botley will appear in this and next week's issue; and they will be found extremely instructive to any gas engineer proposing to introduce electricity in his operations. It is not so much the question of economy as the question of convenience for certain gas-works plant which comes into consideration in applying electricity in gas-works; and it cannot be disputed that the new retort-house machines are better adapted to this form of power than to any other. This fact has caused a distinct shifting of the point of view of many gas engineers. But it was not retort-house machinery that originally led—many years ago now—to the adoption of electricity by Mr. Charles E. Botley at the old gas-works at Hastings, nor that really influenced the introduction of plant at the new Glyne Gap works (where electricity is being used for several purposes), though true a De Brouwer projector has lately been installed. It seems, as Mr. C. F. Botley puts it, the most natural thing in the world for a gas engineer to do, having gas available, to couple up a dynamo to a gas-engine, and so economically convert his gas to electrical energy, if it is more convenient for his special purposes so to do. But Mr. Botley issues the warning that, though the engineer of one gas-works may find it expedient to drive some of his scattered and intermittent plant by electricity, it does not by any means follow that all gas-works should follow suit.

We have said that the articles are instructive. Founded on Mr. Botley's experience, we are told of the limits within which electricity may be used, there are hints as to the plant required, as to installation, as to precautions to be taken to prevent accident, and as to numerous other points which will be of service. The working conditions, writes Mr. Botley, for electric motors are comparatively severe on a gas-works, although gas or steam motors meet the same readily. The striking characteristic of electrical power is convenience; reliability can only be assured by liberal expenditure, both in regard to capital and maintenance charges. With the fine plant at Glyne Gap—at present coal gas is used—the works' cost for current is found to be under ½d. per unit, and will be less when power gas is employed. When Hastings first put in a small electrical set, it was partly for educational purposes, and to show what a gas-engine connected up to a dynamo could do. The analysis in an electrical contemporary of the accounts of the Hastings Corporation Electricity Department places their works' costs at 1·45d. for the fifteen months ending March 31, 1906. In view of this, the Glyne Gap plant has certainly an educational value. The Borough Electricity Engineer will not now wonder at the temerity of the Gas Company in once offering to save the ratepayers' money by lighting the front with electricity, if electricity was preferred, at a much less expense than that at which the Corporation were doing it themselves. Yet the Corporation did not accept the offer. It is a soulless local authority who can spurn a proposal seriously made by a responsible Company to save the ratepayers' money. However, that is beside the main question of these useful articles by Mr. Botley.

The Holborn Explosion.

AN explosion of gas accompanied by fatal results is always regrettable; but considering the vastness of the gas industry, the magnitude of its manufacturing operations, the marvellous ramifications of the canalization, and the myriads of points of gas consumption, it must be claimed that there is reason for gratification that the accidents are so few. It has to be remembered that there is no industry really comparable with the gas industry in regard to the ground it covers; in other words, there is no industry that, outside the pales of its numerous manufacturing premises, distributes so completely and so systematically as is the case with gas. Water supply, of course, matches it in the latter respect; but water is not the product of a manufacturing industry. In view of these conditions, we repeat that there is cause for gratification that accident is so scarce. An inquest was held a few days since on the body of a poor fellow—Harry Tansley, an employee of the Gaslight and Coke Company —whose life was taken by a gas explosion in a street off Holborn on July 30; and a verdict of "Death from mis-"adventure" was returned by the Jury. No other verdict on the evidence was possible. But pursuing the subject of the comparative freedom of the gas industry from fatalities of the kind, the figures quoted by Mr. Corbet Woodall at the last meeting of the Gaslight and Coke Company come to memory. The Company now have between 400,000 and 500,000 consumers, a network of mains extending over 2000 miles, and covering some 60 square miles of territory. Yet since 1895, there have only been three such accidents as the one in Holborn. At the inquest, the Distributing Engineer (Mr. G. F. L. Foulger) supplemented this information with the statement that in his department there are as many as 1500 men in the direct employment of the Company, and probably another 1500 men are employed by contractors to the Company. The fewness of the accidents is an attestation to the discipline that exists among this army of men, to the care they exercise, and to their sense of responsibility. Naturally in such an explosion as this in Holborn, the evidence explanatory of cause—the event wiping out all that is definite—can only be hypothetical; but to the framework of circumstantial testimony and of known facts, Mr. Foulger furnished, experts will concede, the evidence that it is safe to assume fairly fits the blanks. His testimony at the inquest was of real public importance and value, and was couched in language that would command popular interest; but the editors of the daily papers apparently hold views deviating from our own on this particular point.

The Atmosphere of London.

With the advent of October, the thoughts of Londoners turn to morning mists and a possible visitation of fog in the not distant future. These, of course, are natural phenomena which we cannot control; and therefore we have to bear them with as much complacency as we can. In regard, however, to the usual accompaniment of fog—namely, smoke—we are not so helpless; and as the result of legislative enactments, and, we may add, of the efforts of the gas companies in encouraging the use of gaseous fuel, the smoke nuisance has been greatly abated, and the Metropolis is gradually losing an unenviable reputation which has so long attached to it. After all, the atmosphere of London is not, on the whole, so black as it is very often painted. The writer of these lines has frequently seen the City, on a Sunday afternoon in August, bathed in sunshine, with an atmosphere as clear and a sky as blue as would be found in Italy. Indeed, some few years ago, a Lord Mayor who had travelled in that country bore testimony to this fact. Long before that, Mr. Sugg pointed out that it was not till the fires were started to prepare the morning meal, that the air of London became smoky. The penny-in-the-slot

gas-meter and the cooking-stove have got rid of much of this trouble; while the substitution of gas-ranges for those burning coal in the restaurants of the City, has helped to render the atmosphere at midday clearer than it otherwise would be. Proof of this was afforded recently by reproductions in the "Daily Mirror" of two photographs taken the previous day from the Golden Gallery of St. Paul's. Our contemporary considers that they show London with as clear an atmosphere as that of Paris, Vienna, or Rome. Curiously enough, a personal friend of the writer's was on the lower (the stone) gallery of the Cathedral about the time the photographs were taken; and he does not regard this language as being at all exaggerated. Of course there were some offending chimneys. "Looking due south," we are told, "one single puff of smoke came as a blot on the picture," and, strange to say, it was from the chimney of the City of London Electric Lighting Company's works. It is not a little singular that the chimney at the electric light station was the only smoke-producer at Eastbourne on the occasion when Mr. H. E Jones, the Gas Company's Consulting Engineer, was driving into the town with Mr. Hammond, the Resident Engineer, as mentioned by him at the recent meeting of shareholders. So that while gas suppliers have done much, and are still striving, to clear the air, their rivals are helping to pollute it.

A Profit-Sharing Scheme in Boston (U.S.A.).

Our readers may remember that the Boston Consolidated Gas Company have obtained an Act sanctioning a sliding-scale of price and dividends. As a sequel to this, the Directors resolved in July last to extend the principle to the employees, and to offer the most efficient of them an annual share in the profits or premium, over and above their regular compensation, to be employed in the purchase of preferred stock of the Massachusetts Gas Companies. The first premium is to be at the rate of 7 per cent. on the salaries or earnings for the nine months ending June 30, 1907. The plan is experimental, and its success and continuance depend wholly upon the employees. Unless their added interest results in greater economy and profit to the Company and improved service to the public, as well as in financial benefit to the employees themselves, the scheme will be abandoned. The selection of the employees to receive the premium will be made by the Directors, with the advice of foremen and others in a position to judge of their worthiness to receive it; but it is their intention and desire to ultimately include all employees who, in their judgment, are "temperate, energetic, honest, capable, and efficient." When the amount credited to any employee is sufficient to purchase one or more preferred shares in the Gas Companies named at their then market price, the President of the Company will, at his discretion, either pay to the employee in cash the amount of the premium or premiums, or purchase shares on his account. The shares so bought will remain the absolute property of the employee, who will take the dividends due thereon; but he must not sell them without the sanction of the Directors. Should he do so, he will be excluded from the list of profit-sharers for one year at least. Any employee wishing to add to his premiums may do so; and he will be allowed interest at the rate of 4 per cent. per annum upon the amount. The foregoing are the outlines of the first profit-sharing scheme, so far as we are aware, introduced into an American gas undertaking; and we shall watch its progress with considerable interest.

The Miners' Federation of Great Britain.

There are many respects in which the meetings of the Miners' Federation of Great Britain resemble the Trades Union Congress; and not the least of them is the unfailing regularity with which the same questions crop up year after year. The former body held their annual conference at Swansea last week, under the presidency of Mr. Enoch Edwards, M.P., who, it is pleasing to note, acknowledged the advantages of the Conciliation Boards for settling wages questions over "the old days of war and strife." Strikes, he very truly added, were a menace to the best interests of the workers; a truth which is so palpable that the only wonder is it was not universally recognized long ago. One of the first items to be considered was the familiar eight-hour day; and after a long discussion the customary resolution in favour of it was passed. For nearly twenty years now the Federation have been striving for a legal eight-hour day; and it is difficult to measure the progress that has been made towards the attainment of their object. Some of the speeches on the present occasion were of a very fiery character, and showed deep disappointment at the failure of the Government to push through the Bill on the subject which passed its second reading last session; but it was frankly recognized by Mr. J. Wadsworth, M.P., that the real difficulty was that the miners themselves were not unanimous on the question —Durham and Northumberland being still against an eight-hour day. A motion in favour of old-age pensions was agreed to unanimously; and it may be noted that the reason for it was stated to be the large number of aged workmen who have been dismissed from their employment in consequence of the operation of the Workmen's Compensation Act. Clearly, therefore, among the miners the Act has proved to be anything but an unmixed blessing. The Federation have not changed their mind as to the advisability of the nationalization of mines and minerals; but they will doubtless have still further opportunities of "re-affirming their previous resolution" on this subject.

PERSONAL.

Mr. S. B. Langlands, at one time Manager of the Coleraine Gas-Works, and latterly of the Gas Street-Main Department in Glasgow, has been appointed by the Corporation Inspector of Lighting in the city.

Mr. Charles L. Ireland, assistant to Mr. Wilcock, the Manager of the Shipley Gas-Works, has been appointed Manager of the Dipton Gas-Works, Durham. Mr. Ireland was at the Colne Gas-Works for some four years before going to Shipley.

At the Romford Gas Company's works last Friday, Mr. W. D. Child, the Company's Engineer and Manager, was presented with a gold watch, inscribed as follows: "Presented to W. D. Child, Esq., by the Staff and Employees of the Romford Gas and Coke Company, as a mark of esteem after thirty years' service as Engineer and Manager.—September, 1906." Mr. J. W. Harvey, the Secretary to the Company, in making the presentation on behalf of the subscribers—who included the whole of the staff and employees—spoke eulogistically of Mr. Child's valuable services; adding that he had been a great friend to everyone in the employment of the Company. To show their appreciation, he asked Mr. Child's acceptance of the watch as a token of their regard. Mr. Child, in thanking the donors, said it gave him great pleasure to be the recipient of so valuable a present. He should prize the gift more than anything he had received in his life. It came as an absolute surprise to him; and he thanked them all for this token of their appreciation and goodwill towards him. Three hearty cheers were then given for Mr. Child, and the proceedings shortly afterwards closed.

OBITUARY.

The death is announced of Mr. W. Naylor Carne, a Director of the Falmouth Gas Company. He was actively associated with the commercial life of Falmouth and Truro for many years as the head of a firm of brewers and shipping agents, and a partner in other concerns in the neighbourhood. The funeral took place last Wednesday at St. Agnes, North Cornwall (where Mr. Carne resided), and was attended by a large number of persons with whom he had been associated in business and in public affairs.

Ammonia-Spent Liquor.

Last week we published an article dealing with the methods of disposal of this product and, we think, conclusively showed that it is amenable to effective purification, and described its effect, after purification, upon sewage treatment when passed into works drains. We are now informed that a chemical works situated upon a canal the property of the Midland Railway Company have been under an injunction because of their pollution of the canal and destruction of fish by the spent liquor. But after an examination by the experts appointed by the Midland Railway of the effect of the process of purification, the chemical works has decided to adopt that process. This is important as showing the harmless character of the purified effluent under other circumstances.

The Scottish Junior Gas Association (Western District) will hold their annual meeting in Glasgow next Saturday. After the adoption of the accounts and the election of office bearers, the first meeting of the session 1906-7 will be held, when the President (Mr. James M'Leod, F.I.C.) will deliver his Inaugural address, which will deal chiefly with the scrubbing of coal gas.

GAS STOCK AND SHARE MARKET.

(For Stock and Share List, see p. 124.)

On the Stock Exchange last week business was for the most part quiet and dull, though spurts occasionally were started in a few lines, in which the American Market was perhaps the most conspicuous. But anxious eyes were kept constantly on the Money Market, which required more watching than ever—recent developments producing novelties, for which veteran experience was unprepared. Among disquieting factors were the question of Russia's financial position abroad and the looming ahead of labour difficulties at home. The bad weather, too, in the earlier part of the week helped to depress things; so that, altogether, the week was not a bright one, and the aspect at the close afforded no lighter prospect. In the Money Market, after a rather shy opening, the tendency became easier for short loans; but discount rates held firm. What action the Bank of England would take on Thursday was a question as to which opinions differed sharply; and when the decision to abolish the dual rates and let the official minimum stand was announced, it was not universally welcomed. A large withdrawal of gold on Saturday came too late to touch the business of the day; but next week will feel it. Business in the Gas Market was a fair moderate quantity; and it was more even and steady than in the previous week—no one day being much more active than another. There was very little movement; and none of any importance either way. But the market seemed to be in some degree affected by the general unrest and uncertainty, so far as regards debenture stocks and such like of the gilt-edged issues which are more open to monetary influences. In Gaslight and Coke, the ordinary stock was moderately dealt in, and at exactly the same figures as the week before—viz., a range of from 99½ to 100¼. In the secured issues, there were more transactions; and prices gave way a little. Dealings in the maximum were at 89 special, and 90; in the preference, from 109½ to 108 (a fall of 1 in the quotation); and in the debenture, from 84¼ to 85¼ (also a fall of 1). South Metropolitan was quiet and firm; the transactions marked being from 132½ to 134. The debenture was done at 86½. Commercials were little noticed. The 4 per cent. changed hands at 113¾ to 114; and the 3½ per cent. at 110 and 110¼. The Suburban and Provincial group presented a few transactions. Bournemouth "B" marked 15 13/16 and 16, Brighton ordinary 165½, and British 41¼ and 40¼. Tottenham "B" advanced 2½, and West Ham ordinary receded 1; but no business was marked in either. In the Continental Companies, Imperial was only moderately dealt in, but was very steady. Transactions were within the limits of 186½ and 188. The debenture was done at 96½. Union changed hands at 124 and 124½; and Europeans were rather brisk, the fully-paid marking from 24⅜ to 24⅝, and the part-paid 18¾ and 18 11/16. Among the undertakings of the remoter world, Bombay was done at 7, Buenos Ayres at 12⅜, Primitiva ordinary at 7 1/16 and 7 1/32, ditto preference at 5 1/16 and 5⅛, River Plate at from 13 to 13¼ (a fall of a ¼), and ditto debenture at 97.

The closing prices are shown in our Stock and Share List on page 124.

ELECTRIC LIGHTING MEMORANDA.

Old Lamps and New—Working for Lower Consumptions—Definite Practical Results Awaited—Efforts to Restrain Errant Currents in America—Some Conditions under which Pipes are Electrolytically Affected—Train Lighting by Gas and Electricity.

In a recent paper published in Germany, Dr. C. R. Böhm has endeavoured to show precisely the stage at which the electrical industry has arrived in the production of new lamps of the lower powers. All advance in electric lamps, as Sir William Preece was lately lamenting, has come to this country from abroad; and Dr. Böhm's article reflects how eager are the factories in other countries, and how little is being done in this country, to secure some material advantage over the carbon filament lamp, and, incidentally, how difficult it is to do so, in respect of improved efficiency, without accompanying defects of one kind or another. A weary journey has been the quest for increased efficiency in the lower power lamps. In the carbon filament types, even when at their best and working under the most favourable conditions, it has been found impossible to get lower than 2½ watts per candle power, which is not, of course, the average consumption during the lifetime of such lamps. Dr. Böhm, in his many-columned article, turns attention to the lamps in which osmium, iridium, zirconium, tantalum, and tungsten are employed, as well as to the Cooper-Hewitt mercury lamp. It being necessary for gas men to be kept well informed as to what authorities such as Dr. Böhm have to say concerning these new claimants to improved merit, we may glance over his article.

He commences with the Nernst lamp; and he points to the objection that it is necessary to provide means for heating the filament before it begins to conduct. All sorts of attempts have been made to deal with the matter of preliminary heating in this lamp; but the fact remains that the time required for heating and lighting the filament, together with its sensibility to variations of current, continue to militate against its general adoption. As to the osmium lamp, there is first of all the question of obtaining the necessary osmium; and it seems that Baron Auer von Welsbach, before publishing his invention, took the precaution of buying up all the known sources of osmium. His faith was great; but we have a suspicion that the speculation has not yet turned out a very lucrative one. The lamp itself labours under the double disadvantage of high initial cost and low voltage; and like complaint can be made of several of the other newcomers. The maximum voltage up to the present is 47; consequently, on an ordinary network, they require to be run in series with all the consequent complication. The efficiency is said to be 1·5 watts per candle; but here let it be said that the efficiences quoted are, of course, with good conditioned lamps. The lamp has the further disadvantage of requiring to be hung in a vertical position, as osmium becomes soft on heating. As to the tantalum lamp, when heated, it becomes soft like osmium; and after burning for 200 or 300 hours, it is easily broken; and it is therefore very necessary to protect the lamp from vibration. [Parenthetically, it may be stated here that Dr. Böhm has in another quarter pointed out that recent tantalum lamps stand the heat much worse than those first made; for while originally they attained, with alternating current, a life of several hundred hours, they now often burn out in fifty hours, and some have been known to burn out in ten hours. Explanation of this has yet to be discovered.] The filament can be made in a suitable length to take 110 volts; and it can be suspended in any position. Its efficiency is about the same as the osmium lamp. The lamp is sold at 2s. 6d.; but its economy is said to be eclipsed by the latest forms of zirconium and tungsten lamps. The performances of these newer lamps, however, appear to be based entirely on manufacturers' statements and laboratory tests. On the whole, Dr. Böhm does not go into rapturous commendation of invention immediately succeeding the carbon filament lamps.

But coming to these later developments, which appear to be still mostly in an embryo state. Taking the zirconium lamps, several forms of which have been made, filaments tested by Wedding took 2 watts per candle power; but they are intended for low voltage. Then there are the zirconium-carbon lamps, and others of similar class but containing also tungsten. One form of these is declared by the manufacturer to take only 1 watt per candle power, and to have an average life of 500 hours. These lamps are being sold at the rate of 3s. for a 40-volt lamp, 3s. 6d. for one taking 75 volts, and 4s. for one of 120 volts. Following comes the iridium lamp, which is also for low voltages, and can hardly be regarded as a serious rival of the carbon filament, especially seeing that the sources from which iridium can be obtained are not by any means numerous. The lamps only take 24 volts, are sold at 3s. 6d. each, but are said to use only from 1 to 1·5 watts per candle power. The latest novelty is undoubtedly the tungsten lamp, which is being made according to four different processes. It is intended, under the patents of Just and Hanaman, to make a lamp for 110 volts, giving from 30 to 40 candle power; and taking 1·1 watts per candle. Even a better efficiency is hoped for. The Kuzel tungsten lamps are found, by the manufacturer, to take between 19 and 32 volts, and to have a "useful" life of 1000 hours, at 1 to 1·25 watts per candle power, with a total loss of light of 10 to 15 per cent. The lamps are credited with being able to mend any fractures automatically, as in the case of the tantalum lamps. From osmium lamps, attention has been turned in the same producing quarter to tungsten and molybdenum; and in the same factory lamps are now being made under the names of the osmin and osram. It is not likely that it will be possible to make these lamps of less than 35 to 40 candle power. But this, it is thought, may prove to be no serious disadvantage, "seeing that the lamps, burning at 1 watt per candle power, would only take as much current as a 10-candle power carbon filament." The osmin lamp, according to one test, gave 55 candles at 110 volts, and took 1·02 watts per candle power. Another test showed an efficiency of 1·03 watts per candle power; and, "after burning 1776 hours, the efficiency was still 1·09 watts per candle power." It is intended to manufacture osmin lamps of 40, 50, and 60 candle power for 105 and 110 volts. Some tests of the osram lamp (consisting of a mixture of osmium and tungsten) ascribe to 25-candle power lamps, after burning 500 hours, an efficiency of 1·12 watts per candle power, and 32-candle power lamps 1·08 watts. The osram lamps are to be made for 220 volts; and those giving 40 to 50 candle power will not, it is hoped, take more than 1·2 watts per candle. There is a good deal of hope clinging to these tungsten lamps. Dr. Böhm is very non-committal concerning them, for he says whether they will fulfil the expectations that have been made "remains to be seen." Precisely. At present, they are largely in the laboratory stage, though some are actually being manufactured. In any case, they are, Dr. Böhm also remarks, in that state in which a certain amount of privacy seems not only desirable, but necessary. In his references to the Cooper-Hewitt mercury lamp, the Doctor states the efficiency at between 0·33 and 0·15 watt per candle power, which is about the result credited to the flame arc lamp, with its large but concentrated illuminating power. But the Cooper-Hewitt lamp—which is rather expensive, but is stated to have a long life with proper handling—falls into a different category from those to which attention has been devoted here. The chief point about these newer lamps is that the makers are striving, and striving hard, to produce types, taking only 1 watt per candle power; but whether they will succeed in turning out a reliable, practical lamp is another

matter. There is little information on that score yet, nor is there as to whether the low consumption is a continuous one under ordinary conditions. However, in this country, voltages of over 200 are becoming general; and without complicating supply, and, as a matter of fact, making it more expensive for the consumer, there is not much scope here for these low voltage lamps.

There was a time, and not long ago, when, in the electrical Press, the question of electrolytic action on underground pipes was scoffed at as a bogey created by gas engineers in the hope of adding to their scores off the electrical rival. Lately, however, it is noticed that our contemporaries have taken to publishing the results of some of the researches of scientific men into this matter. And if they read, mark, learn and inwardly digest the erudite statements that are published, they cannot surely continue to urge that there is nothing in the contention of gas engineers, or that greater protection ought not to be allowed against damage done to other folks' property through the introduction of distributed electricity, and particularly against negligence in installing and working electrical systems. In a recent issue of the "Electrical Review," two articles appeared touching upon the subject—the one in the form of a semi-editorial, and the other a translation of the views of Messrs. Haber and Goldschmidt, as published in a German electrical contemporary, of the effect of earth return current on iron pipes. The editorial notes referred to are based upon an article by Mr. A. A. Knudson in "Cassier's Magazine," in which he relates the different attempts made in America to minimize electrolysis due to the nomadic currents of tramway systems; but there does not appear to be one attempt that can be said to have been perfect. Using a second insulated wire over each track as a return conductor, and reinforcing this when necessary by feeders, even then, it is said, the rails have known more about return currents than the authorities who imposed the system would like to hear about. With 60-feet rails, and the welding into continuous lengths, a water or gas main, or a lead-sheathed cable may still prove an irresistibly attractive path for part of the tramway current. The ordinary tramways in the States have bonded joints, which may not be in too good a state of repair, and are unassisted by anything but neighbourly pipes for carrying the return current. Reading on, no other road to perfection or security is detected. It is pointed out that, "with the idea of preventing damage to pipes, they have either been enlisted frankly into the tramway service by bonding them to the rails near the power house, or to special cables straight to the negative bars, or their Samaritan instincts have been checked by insulating their joints." The insulating of joints has become a common practice in America; but it is doubtful (from the information contained here) whether the remedy for the trouble does not produce something even worse. The bonding system, we are told, "would be excellent, if the pipes themselves were electrically continuous; but too often considerable resistance is offered by the joints. The bonding may have made the pipes more attractive than before; and the pitting trouble will then be accentuated in that pipe-line, and may even widen the danger area by inducing other pipes to take part in the distribution of the return current. The more one bonds, the more one has to bond, if all damage is to be avoided. Insulated joints at a few particularly dangerous places are effective sometimes; but the cost of doing the thing thoroughly is prohibitive. Insulating the whole pipe has been tried in a few cases, but with no success." Where, in view of all this admission, are pipe-owners to look for adequate protection?

Our contemporary points out the difficulty that there may, in cases, be of positively proving that the destruction of a pipe is attributable to the action of stray electric currents. This may be so; but there can be no denial that the distribution of electricity in the streets has introduced a potent and destructive influence into the life of pipes. We are afraid, in fact, that the slow depreciation of pipes by current is a more treacherous evil than where the current is active, and quickly declares the result of its pernicious action. In the report which was presented at the last meeting of the German Association of Gas and Water Engineers, there were points which indisputably showed that pipes were, in certain districts that had been under observation, becoming more rapidly weakened than there was precedent for; and there is unquestionably still much of the unknown about the subject. Ground conditions no doubt contribute largely to the activity of errant current; and it is to this what may be called contributory cause that the researches of Messrs. Haber and Goldschmidt have been largely directed. We are not going minutely into their learned composition, but shall be satisfied by picking out a few points which have a bearing upon the subject of the slow deterioration of pipes. It is seen that the surface of cast-iron pipes will become soft under the action of electric current; and that the chemical effects of such currents on iron are similar to rusting. Regarding the insulation of pipes, it is remarked that if the insulation happens to break down at points, this would increase the danger of rapid pipe destruction, by encouraging high current densities at these places. Current density can also be increased at certain points by the fact that the products of decomposition themselves increase the conductivity of the earth. Sometimes, too, an attacked pipe will continue to be eaten away by ordinary rust action without any further passage of current. The presence of high conductivity zones in the earth is also dangerous on account of the localization of the current. A high current density at the pipe surface may, in material containing carbonic acid, cause trouble through transforming iron in the passive state (capable of resisting attack) into active iron (liable to disintegration). The experiments have convinced the investigators that: Disintegration only occurs when the iron is in the active, and not when it is in the passive, condition. Since the state of the iron depends on the chemical composition of the earth, the ground conditions decide whether the iron is in danger or not. Reversal of current is only advantageous in certain cases. Pipes attacked chemically are not readily distinguished by the eye from those attacked electrolytically; and this being the case, we may add, that the trouble is that no end of pipes may be attacked electrolytically, and yet the damage be wrongly attributed to chemical action. Finally, it is learnt from these investigators that, in the active state, disintegration will take place even at the smallest voltages, but thankfully it is noticed that there is a stage in the voltage where it is not usually appreciably harmful—that is "*below* about 1 volt!" The researches prove how multifarious are the conditions under which pipes may be attacked; and, being so multifarious, the seriousness is increased.

One of the paragraphs in the "Memoranda" last week dealt with the question of railway accidents and train-lighting arrangements, and it was mentioned that the electricians had taken up with vigour a point that they thought would stop the growing appreciation of railway lighting by gas, and give electricity a better look in. At the end of an editorial in the "Electrical Review," dealing with the recent Grantham disaster, appear these vividly imaginative words: "Beyond question, the most ghastly feature of these terrible catastrophes is the fact that some of the victims are roasted alive, in the sight of would-be rescuers. These shocking scenes will continue to recur until railway companies entirely give up the use of gas for train lighting, and adopt one or other of the many excellent electrical systems which have been developed for this purpose." We should like to know just where victims have been "roasted alive" in the sight of would-be rescuers.

GAS ACTS FOR 1906.

We have now to complete the chapter of gas legislation for the session of 1906, by reviewing the Acts. As usual, commencement will be made with those Companies who applied for the first time for parliamentary powers by way of a Bill.

The first is the Act of the Crediton Gas Company by which they have become incorporated, and have been raised to the full status of a statutory concern; the property of the old Limited Company being vested in them. Their district has been extended. The capital asked for in the Bill has been considerably reduced; and it now only amounts to £14,100, whereof £9300 represents the orginal capital, and £4800 the additional capital. The Company are to be allowed to borrow (inclusive of the £3000 already borrowed) up to one-third of the original capital, and not exceeding £1400 in respect of the additional capital. The interest on the borrowed capital is not to be higher than 4½ per cent. The standard dlvidends are limited to 10 per cent. on the original ordinary capital, 5 per cent. on the preference capital, and 7 per cent. on the additional capital; but no dividend on the ordinary capital is to be paid at a rate exceeding 5 per cent. per annum in respect of any half year, unless the charge for gas in the urban district shall for such half year have been less than 4s. 6d. per 1000 cubic feet. Insurance, renewal, and reserve funds are provided for. The Company have had to give way a little on the standard prices, which are now fixed at 4s. 6d. within Crediton and at 5s. beyond. Applying half-yearly, changes in the price of gas of 1d. will carry variations in dividend of 2s. 6d. on the 10 per cent. capital and 1s. 9d. on the 7 per cent. capital. The illuminating power is to be 14 candles, tested by the Metropolitan argand No. 2 burner, with Harcourt's 10-candle pentane lamp, and a bar photometer. Discounts are to be at rates not exceeding 10 per cent. for prompt payment, and 15 per cent. for large consumption. Power to purchase land by agreement up to 5 acres is granted. The auditors are to be members of the Institute of Chartered Accountants. The whole of the electric lighting powers were eliminated from the Bill. [*Parliamentary Agents: Messrs. Lees and Butterworth.*]

The Dowlais Gas and Coke Company have been incorporated and statutory powers conferred upon them, under which they will take over the property of the Limited Company. By rather over £11,000 the capital originally asked for has been reduced to £52,750 ordinary stock, bearing a standard rate of dividend of 5 per cent. Of the total, £42,750 of consolidated ordinary stock is to be deemed to represent the original capital, and £10,000 the additional capital. Borrowing powers are granted to an amount not exceeding £8585 in respect of the original capital, and £3333 in respect of the additional capital. An insurance fund is provided for; but for the purposes of the section the existing paid-up capital is deemed to be £25,750. Regarding the application of excess profits, they may be carried to the credit of the divisible profits of the undertaking for the next following year, until the amount shall be equal to 6d. per 1000 cubic feet of gas sold. A reserve fund is also provided for. There are a number of clauses for the protection of the Corporation in regard to the laying of pipes, which are to be laid "in such position in or at the side" of the street or bridge "as the Corporation in writing under the

hand of their Surveyor may direct." The notice as to the breaking up of streets is to be seven days, instead of three. The other clauses in this connection refer to the provision of plans, the repairing of roadways, and requirement as to the alteration of the position of pipes in connection with town improvements, &c. The purchase of land by agreement up to 5 acres is conferred. The standard price of gas asked for has gone down by 1s.—to 3s. 6d.—per 1000 cubic feet; and the sliding-scale is applied on the basis of 1d. alterations of price in any half year carrying 1s. 3d. changes in dividend. The price of gas for public lighting is not to exceed 3s. 3d. per 1000 cubic feet. The excess charges for prepayment meter supply are the model ones of 10d., 1s. if including cooker, and 6d. for meter alone. But the Company are to be entitled to charge 1d. for any less quantity than 100 cubic feet. The illuminating power of the gas is to be 14 candles; and "the burner and other apparatus to be used for testing the gas, and the method and rules to be observed in the testing, shall be such as are for the time being prescribed for testing the illuminating power of gas under the provisions of the London Gas Act, 1905, in cases where the illuminating power required is the same as that required by this Act." Discounts are allowed up to 10 per cent. for prompt payment and 15 per cent. for large consumption. A purchase clause, operative only in "the next available session," appears. Various conditions attach, including compensation to any officers or servants not retained in the employ of the Corporation, and to the Manager if he elects to retire. [*Parliamentary Agents: Messrs. W. & W. M. Bell.*]

The Truro Gas Company are incorporated; and, under their Act, they enter into possession of the property of the old Limited Company. In great part, the provisions of the Act are the same as those contained in the Bill. The capital is to be £60,000, whereof £37,500 is to be ordinary stock in substitution of existing shares, and £22,500 additional capital. Including £8000 already borrowed, the Company may borrow up to £20,000. Before submitting stock for sale by auction or tender, it may be offered to consumers of gas or employees. The standard rate of dividend is to be 5 per cent.; the standard price of coal gas is to be 4s. 2d. per 1000 cubic feet; and penny reductions or increases in price are to carry increases or reductions in dividend of 2s. 6d. per cent. Reserve, insurance, and renewal funds are all provided for. The Company are given power to construct a short length of tramway; and, regarding lands, they may purchase by agreement up to 5 acres. The illuminating power of the gas is specified at 13 candles; and the burner used in testing it is to be the Metropolitan argand No. 2. Respecting discounts, the Company may allow them, in consideration of prompt payment, up to 25 per cent.; and, if they think fit, they may "allow discounts or rebates in consideration of large consumption, or in respect of gas supplied by contract or for motive power upon such scale, and subject to such conditions and regulations as may be prescribed by special contract in writing between the Company and any such consumers." Authorization to supply power gas is given; but the Company are not to be compelled to supply any person unless he is willing to contract for not less than 1 million cubic feet in any six months. Other persons not being willing to so contract may demand a supply; but the Company, in their absolute discretion, may discontinue the supply on giving six months' notice. The Company are not to supply the power gas for use in private dwelling-houses; and the gas is to have a distinctive and readily perceptible smell. Any contravention of this will subject the Company to a fine not exceeding £50. The use of a proportional meter is authorized for power-gas consumption. Provision is made for the penalty testing of the power gas, which is to have a minimum heating value of 250 B.Th.U. per cubic foot. For such gas, a charge not exceeding 1s. 6d. per 1000 cubic feet may be made, with an extra 1d. for every additional 25 B.Th.U. The Secretary of State for the Home Department may at any time before or after the Company commence to give a supply of power gas make or impose, in the interests of safety to persons, regulations, terms, and conditions with respect to such supply. But if the terms and conditions, in the opinion of the Company, render the continued supply unremunerative or impracticable, they may give consumers three months' notice of their intention to discontinue it. The Company are also to be subject to any General Act referring to power gas that may hereafter be passed. Authorization is given, if thought fit, to apply for an Electric Lighting Order. A purchase clause has been inserted in favour of the Corporation, giving them the range of seven years within which to apply, without the Company's opposition, for power to acquire the undertaking. A compensation clause is included for officers and servants in the regular employ of the Company who may not be retained, and no person or officer who has been in the Company's employ ten years or upwards is to lose his right to compensation by reason of his declining to enter the service of the Corporation. [*Parliamentary Agents: Messrs. Dyson and Co.*]

A commencement may also be made this week with the Acts conferring upon existing statutory Companies further powers.

Dealing first with the Act of the Ascot District Gas and Electricity Company (which is the extended title of the Company), the limits of supply have been enlarged so as to include the parish of Chobham. The illuminating power of the gas is prescribed at 14 candles; and the price of gas is limited to 5s. per 1000 cubic feet. But the principal part of the Act has reference to the supply of electricity. The area is defined; power is accorded to appropriate scheduled lands for the erection of a generating-station; and authority is given for the purchase by agreement of an additional 5 acres of land. Since the Bill was introduced, the maximum rates of charge for electricity have been reduced, per quarter, to 11s. 8d. up to twenty units and to 7d. per unit beyond. No person is to be entitled to demand of the Company a supply of electrical energy to premises having a separate supply unless such person shall have previously agreed to pay the Company a minimum annual sum sufficient to give them a reasonable return on the capital expenditure and other standing charges incurred by the Company to meet the possible maximum demand of such person. Additional capital to the extent of £30,000 is sanctioned, carrying a dividend not higher than 7 per cent. on ordinary capital and 6 per cent. on preference capital. A further £5000 borrowing power is allowed on the capital authorized under the Act of 1882, and one-third on the additional capital. Power is taken to form a renewal fund. Separate accounts are to be kept for the gas and electricity undertakings. When the separate accounts show that the receipts on the revenue account of the electricity undertaking exceed the sum total of the expenditure on such account (including the authorized payment to the renewal fund) and of a sum equal to 7 per cent. on the aggregate amount of the capital employed in the undertaking, the Company are to make such a rateable reduction in the charge for the supply of electrical energy as in their judgment will reduce the surplus to that maximum rate of profit. The Company may allow discounts not exceeding 10 per cent. for prompt payment and 20 per cent. for large consumption. [*Parliamentary Agents: Messrs. Lees and Butterworth.*]

There is a similarity between the Brixham Gas Company's Act and that of the Ascot Company; for in the main it refers to the supply of electricity. Churston Ferrers is now included in the gas limits of the Company; and the unexercised powers of the Paignton Gas Company in that parish are repealed. Authorization is given to utilize further lands as described in a schedule to the Act for gas manufacturing purposes. All the necessary powers for erecting a generating-station and distributing electricity are granted. The consent of the local authority is not to be unreasonably withheld to the placing of wires overhead, and in the case of dispute there is to be appeal to the Board of Trade. Within a defined area, distributing mains for general electricity supply are to be laid within three years; otherwise, unless they determine to extend the period, the Board of Trade may revoke the powers. The maximum price to be charged for electricity is the same as in the Ascot case, and up to 5 per cent. rebates may be made for prompt payment, and not exceeding 20 per cent. for large consumption. The Brixham Electric Lighting Order of 1903 is repealed. Power to raise £20,000 additional capital is conferred, with one-third borrowing powers. A renewal fund for both undertakings is provided. While separate accounts are to be kept, the aggregate receipts of both concerns are to be brought into calculation in connection with reductions in the price of electricity. The peculiar clause bearing upon this matter was published in the "JOURNAL" for Jan. 9 last, p. 88. Specific provision is made for the purchase of the electricity undertaking by the local authority, within six months, after a period of 21 or 42 years. [*Parliamentary Agents: Messrs. Lees and Butterworth.*]

(*To be continued.*)

Engineering and Machinery Exhibition.

Though a number of influential gentlemen in the world of science were unable to accept the invitation of Sir W. H. White, K.C.B., the President of the above-named exhibition, to the patrons' dinner, which took place at Olympia on Saturday, there was a numerous and distinguished attendance. Sir William occupied the chair, and briefly proposed the loyal toasts, which were duly honoured, as was also the customary one in regard to the two services and the reserve forces, which was entrusted to Sir George Bartley. The presence of five representatives of the Colonies afforded the Chairman an opportunity of rectifying an omission in the programme, and enabled the company to drink success to the important portions of the Empire which are separated from the Mother Country by the seas; and in acknowledging the toast, the Hon. J. G. Jenkins, the Agent-General for South Australia, in an able speech, testified to the value of the work of the engineer in contributing to our colonial prosperity. The toast of the evening—"Success to the Engineering Industry and the Exhibition" was proposed by Sir Edwin Cornwall, M.P. In responding, Sir William White said he believed the exhibition would be of great service to the national industry. Since it was opened three weeks previously, it had been well attended; and he hoped its success would continue till the end. He disclaimed any personal credit in connection with the exhibition; but those who had promoted it were, he said, under a great obligation to the Advisory Committee (on which, it may be remembered, the Institution of Gas Engineers and the Junior Institution of Engineers are represented) and to the lecturers. The other toasts were "The Rising Generation of Engineers," "The Visitors," and "The Chairman;" and in the course of the remarks made in connection with them emphasis was laid on the value of the lectures, one of which—the first of two to be delivered by Mr. H. A. Humphrey, M.Inst.C.E., on "Gas-Engines"—will be found in another part of to-day's "JOURNAL."

COMPARISONS OF GAS WITH ELECTRICITY.

"He is a most able advocate of the case he has in hand; no Gas Company could have a better Counsel than Mr. Goodenough." It was with this remark that a member of the United Wards Club of the City of London last Wednesday proposed a vote of thanks to Mr. F. W. Goodenough, the Chief Inspector of the Gaslight and Coke Company, for a paper he had just read to them on the subject of "The Relative Cost and Advantages of Gas and Electricity." The meeting-place was the Cannon Street Hotel; and there was a goodly muster of business men, keenly interested in the facts and figures that were brought to their notice. The "tale" which the author had to "unfold" was, needless to say, a good one; and he is to be congratulated no less upon his manner of telling it than upon the audience of men engaged in both public and private work in the City who listened to the recital.

The paper was, as far as possible, bereft of technicalities; and an early point touched upon was the unfair competition of municipal electric light undertakings, aided by the rates, with the gas industry, which is one of the largest contributors to the very rates which are called upon to support its competitor. The recent action of the Borough of Marylebone with respect to the lighting of Oxford Street was cited as an instance of the great difficulty of getting a fair decision as between gas and electric light from a municipality who have committed themselves to trading in the latter commodity. It will be remembered that here the Council, notwithstanding the recommendation of the Lighting Committee in favour of gas, decided to instal electricity at a greater cost, and so support their own electric light undertaking. A second case touched upon was Islington, where electric street lighting is being extended, in spite of the fact that the 20 miles of streets at present lighted in this manner cost 25 per cent. more than the 100 miles lighted by gas—that is, six times as much per mile for electricity as for gas. Poplar, also, in burdening the rates by the wholesale use of electricity for the lighting of the streets, is doing the same as practically every municipality in London who own an electricity undertaking. These instances were contrasted with the City, Westminster, Paddington, Kensington, &c., where, though the Electric Light Companies have their friends, the Gas Company on the whole secure fair play. After brief reference to the efforts of some municipalities to bolster up their electricity concerns by insisting on the exclusive use of this light in the dwellings which they have erected for the poor, the author gave two other instances to show the prevalent desire of such authorities to use electric light for everything and in every place that they can. The first was that of a wharf owned by the Shoreditch Borough Council, the electric light bill of which amounts to £227 per annum, as compared with £68 for gas. The other related to two public libraries at Sheffield, which are of practically equal dimensions and worked on identical lines. One is indifferently lighted by electricity at a cost of £75 per annum; while the other is satisfactorily lighted by gas at an outlay of £28 a year.

An important point in connection with this subject, said Mr. Goodenough, is that, in addition to increasing the general rate by using the more costly means of lighting the municipal buildings and the streets, the revenue of the town or borough is reduced whenever business is taken away from the gas company. A gas company, like a railway company, are to a large extent assessed, not only on their buildings, but also according to the amount of business done in the parish. That is to say that, though a gas company have no works in a parish, they are rated upon the mains which pass through the parish according to the amount of gas sold within its area; so that if the electric lighting committee could succeed in destroying the business of the gas company in any borough, they would have destroyed one of the largest sources of revenue to the borough, without substituting an equivalent in any shape or form. Roughly speaking, the profit which goes to the local authorities in the shape of rates represents something like 10 per cent. on the total business of the company; and if the gas industry could be wiped out of London so far as the Gaslight and Coke Company are concerned, the rates would be the losers to the extent of nearly £300,000 per annum. And this, he remarked, is what electric lighting friends would like to do, in spite of the fact that the municipal electricity undertakings of London, if their finances were properly adjusted, would not show any profit to the rates, while those responsible for the concerns take very good care that the works and cables are not assessed for rating purposes at anything approaching the figure at which a similar undertaking owned by private individuals would be. Before leaving this branch of the question, one of the weak points of municipal trading was drawn attention to—that the administration is often in the hands of men having no great stake in the community, and who are not able to take broad views and form wise judgments as to what is really advantageous to the community as a whole.

Coming to the relative advantages of gas and electricity, the first matter touched upon was fire risk. It is, said Mr. Goodenough, an undoubted fact that many fires have in recent years been caused by electricity; and it is also undoubtedly the keen competition in electric light wiring that has of late times led to a great deal of inferior material being used for the wiring of houses, which must eventually lead to many disasters. In support of this contention, he quoted the following remarks from the address read last year by the President at the Annual Convention of the Incorporated Municipal Electrical Association: "The cost of installing electric light is a very serious consideration to the small householder. That this is so, is shown by local authorities themselves wiring houses on what are called easy-payment terms. . . The poor quality of the material used, and the unsatisfactory way in which the work is carried out, are certain to give trouble . . . . Contractors for electric installation work naturally buy the cheapest material they can, especially as competition in this class of work is very severe. . . . On account of the use of inferior material and bad workmanship, fires have occurred through electricity. This in time may shake the confidence of the public in the safety of electric light." Mr. Goodenough was careful to make it clear that he did not allude to these risks involved in the use of electric light as an argument against electricity and in favour of gas. He simply did so in order to show the ridiculous absurdity of the suppliers of electricity spending their time in calling the attention of the people—he had previously referred to that new publication, the "Electrical Bulletin"—to the disastrous results of looking for an escape of gas with a lighted candle, as if gas had the monopoly of risk attending its use, while the employment of electricity was entirely devoid of danger.

The action of the heat of an incandescent burner in sterilizing the air passing through it, and the superiority of gas over electricity as a ventilating medium, were next pointed out; the opinions of Dr. Henry Aiken and Professor Percy Frankland being quoted in connection with the latter. Of course, the author said, no one would dream of denying that where heat is a decided objection electricity is preferable to gas; and it is also more suitable than gas where, for decorative purposes, it is desired to place the lights around the moulding of the ceiling or inside show-cases, or in low-pitched rooms having valuable decorations which might be damaged by exposure to the heat from gas. But in regard to the ceilings of rooms of ordinary height, properly protected gas-burners should certainly not render it necessary to clean the ceilings more frequently than sanitary precautions would require. As to blackening caused by the dust and dirt in the atmosphere being driven against the ceiling by the up-current of heat from the burner, it was pointed out that a heat disperser placed over the burner will to a large extent obviate this difficulty; while the use of inverted burners, having an inverted cone which disperses the heat widely, practically abolishes the trouble of darkened ceilings altogether, besides enabling gas to run electric light very close in regard to its decorative possibilities. Mention was also made of the fact that easy switching on and off is not now confined to electricity, as, by means of the pneumatic lighter, gas can be controlled from a distance in precisely the same way as the electric light. Other points were the injurious effect of the electric light on eyesight, and the benefit which electricity at one time enjoyed through being considered "the fashion."

The last, but all-important, branch of the subject—that of cost—was then reached; and in calculating this, Mr. Goodenough took as his basis 1500 hours of lighting of 1000-candle power, with gas at 2s. 11d. per 1000 cubic feet and electricity at 4d. per unit. In the case of the ordinary electric glow lamp, the accepted consumption is 4 watts per candle power; and as there are 1000 watts in a unit of electricity, the lighting power (assuming the lamps do their duty efficiently) will be 250 candles per unit. Thus 6000 units will be required to give a light of 1000 candles for 1500 hours, the cost of which, at 4d. per unit, would be £100. To this has to be added the cost of lamp renewals, say, £5, which gives a total of £105, without making any deduction for loss of candle power during the life of the lamps. Taking an ordinary incandescent Welsbach burner consuming 4 cubic feet per hour, or an inverted burner consuming about 3 cubic feet per hour, when the mantles are new a light will be obtained of from 20 to 25 candles per cubic foot. With inverted burners over 30 candles per foot could be secured. Deducting 20 per cent. from the average initial light of the incandescent burner—which may be taken at 22 candles per foot—brings the average light down to 17 candles, which is putting the case extremely heavily against gas. On the basis of 17 candles per cubic foot, 90,000 cubic feet would be required for a light of 1000 candles for 1500 hours; and this, at 2s. 11d. per 1000 feet, would cost £13 2s. 6d. Adding to this £4 4s. 6d. (29,000 feet) for a bye-pass throughout the year—a very outside calculation—and £2 5s. for mantle renewals, a total cost is arrived at of £19 12s., for the same light as requires an outlay of £105 with electric glow lamps. For the Nernst lamp, the makers claim an efficiency of 1·4 to 1·7 watts per candle; but judging from the figures given by electrical engineers 2 watts is a fair consumption to reckon for. On this basis, and allowing £3 12s. 6d. for renewals, the cost is £53 12s. 6d., as compared with £19 12s. by gas. For large units of light, there is intensified gas, and taking the low average power of 24 candles per cubic foot for self-intensifying lamps, a consumption of 63,000 feet is arrived at, costing (with £1 4s. for renewals) £10 7s. 9d. For high-pressure lighting, taking 30 candles per foot, the consumption would be 50,000 feet, and the cost (including bye-passes 10s. 8d., and maintenance 18s.) £8 14s. 6d. Then as to arc lamps, the ordinary 10-ampere lamp which used to be called 2000-candle power, is now admitted by electricians to give a light of about 600 candles; and at a consumption of 0·8 watt per candle power, the cost (including £4 for carbon renewals and labour) comes out to £24 for open lamps. If the flame arc lamps are worked out on the basis of the Westminster Laboratory tests, the cost (including carbon renewals and labour) comes out at £12 10s.

At the conclusion of the paper, a hearty vote of thanks to the author was proposed by Mr. George Palmer, who said that he had had several years' experience both with incandescent gas lighting and electricity; and he thought that, for working, the latter was rather more prejudicial to eyesight than gas. His observations led him to believe that gas could not compete with electricity where one had to consider plant life. Mr. D. G. Pope, who seconded, remarked that the subject had been put before them most fairly. Mr. C. W. Parsons said he thought electricity was less abused than gas. Taking light for light, gas might be less expensive; but the careful way in which electricity was used made it cheaper in the end. The easy switching on and off of electric lights rendered it possible to effect a great saving. [Mr. Goodenough subsequently elicited the fact that Mr. Parsons was comparing electricity with flat-flame gas-burners.] Mr. J. M. Klenck was of opinion that the Electric Lighting Companies had rendered good service in London, by bringing down the price of gas. Competition had given them better lights at a very greatly reduced cost. He had that day attended a committee meeting of an Institution the gas bill of which used to be £20, while the present cost of electricity was over £80. Mr. S. Alderton contended that electricity had many advantages. Formerly gas [mostly flat-flame] cost him about £25 per annum; and he had to clean his ceilings and walls once a year, at an outlay of a further £15. Electricity cost him £33 per annum; and the cleaning had to be done only once in seven years. Mr. Jennings had always been taught that they were living in an age of progress; and he looked forward to the cheapening of electricity, which was now only in its infancy. When it became as cheap as gas, no doubt people would be very glad indeed to use it. Mr. J. H. Palmer drew attention to the inverted gas-burner, which, in the case of a church of which he was warden, had been found very effective. In his mind, this would be the light of the future. The President (Mr. Harry Bird, Common Council), in putting the vote to the meeting, said he would just like to refer to the fact that, so far as public lighting was concerned, there was no comparison between gas and electricity. This was fairly evidenced by the action of the Corporation of the City of London, who had taken a great amount of trouble to prove which was the best. Unquestionably the result of their investigations was favourable to incandescent gas. In the case of private houses, however, there were advantages appertaining to the use of electricity.

The vote of thanks having been heartily accorded, Mr. Goodenough briefly replied to the various points that had been raised in the discussion. He remarked that gas could just as easily be turned up and down as was the case with electricity. In his own house, he had a switch at the door to light up the room when entering, and another by the bed to turn the gas out when no longer required. He quite agreed that this was an age of progress. First they had flat-flame burners; then came electricity; and now there was incandescent gas lighting. He believed that there were greater possibilities of advance in gas than in electric lighting, as the electricians had already succeeded in getting fourteen times as much light out of every British Thermal Unit at their command as had the gas engineer. Certainly competition would keep the gas companies alive, as well as the electricity companies. They were going to fight for all they were worth; and fighting was better than going to sleep. The inverted gas-burner was, he agreed, very effective; and undoubtedly it had a great field before it.

WAGES AND HOURS OF LABOUR IN 1905.

Once more the Labour Question is present in a more or less acute form; and there are strikes and rumours of strikes. The Clyde shipbuilding yards are mostly closed, through an attempt by the men to enforce demands which the masters have not so far seen their way to concede; the Welsh miners are determined to take the extreme step of striking, if necessary, in order to drive all the non-Unionists into the fold; and there appears to be the leaven of discontent among a large section of the railway workers. All these considerations lead one to wonder what story there will be to tell next year for Mr. A. Wilson Fox, of the Labour Department of the Board of Trade, whose report on Wages and Hours of Labour during 1905 was issued a few days ago. The present is the thirteenth yearly issue; and it states that the decline which characterized the movement of wages in the preceding four years continued in 1905, though the falling off was much less marked—and, in fact, during the last half of the year an upward tendency was shown, which was continued during the first six months of the present year. This recent upward tendency has been felt in most of the industries; the only important exception being the building trades. As already stated, however, there was a net decrease in 1905; and this was mainly due to reductions in the coal-mining industry, and to a less extent in the building, quarrying, and engineering and shipbuilding trades. Seeing the improving condition of trade, it is not surprising to learn that there were advances in the pig-iron and iron and steel trades, as well as in the textile trades; and no surprise will be caused, also, by the intimation that the employees of public authorities have received increases (though it must in fairness be pointed out that the report is principally concerned with Government servants).

The information at disposal for the compilation of the report shows that nearly 689,000 people had their rates of wages changed during 1905. Of these, about 319,000 received advances amounting to £16,300 a week, and nearly 250,000 sustained decreases totalling about £18,500; while about 120,000 experienced both sensations—having had both upward and downward changes which left their wages finally at the same level as at the beginning of the year. Thus is the net result arrived at of a decrease of nearly £2200 per week. Coal mining is a long way ahead on the side of decreases; the number of people affected being 200,746, and the falling off in weekly wages £13,471. On the brighter side are the textile trades, in connection with which 311,437 persons received a weekly increase in wages of £9915; and on a proportionate basis the employees of public authorities have done even better, for here 29,759 persons enjoyed an additional weekly remuneration of £2333—the severe loss of £2 a week among 14 of such employees not having much effect on the figures. Last year no less than 44·4 per cent. of the changes in wages were arranged by Conciliation Boards, mediation, arbitration, &c., though, of course, this result is largely accounted for by the coal mining industry. The principal changes brought about in this way were those affecting miners in Northumberland and South Wales, which were arranged by joint boards of employers and workpeople, and cotton spinners, with whom mediation was the method adopted. As in the preceding four years, the number of workpeople whose changes took place after a stoppage of work formed but an insignificant fraction of the whole—to be precise, 2·1 per cent. This satisfactory proportion, however, might be to some slight extent modified if account were taken of strikes for higher wages that failed; and, in addition to this, of course, there may have been some threatened strikes or lock-outs which influenced the changes made in wages. Turning to the changes in hours of labour, we find that, as compared with the number of people affected by alterations in wages, the proportion of those whose recognized hours of labour were changed in 1905 was not large; and there does not appear to be any particular feature in this portion of the report.

The figures in connection with wages for the first six months of the current year speak eloquently of good trade. The changes in rates of wages reported show a marked rise; there having been net increases in all branches of trade, with the exception of building and quarrying. No less than 843,325 people had their wages changed; and of these all but about 10,000 found the alteration advantageous. A net increase amounting to £27,087 per week was received by 832,526 workers; while 6669 suffered the small net decrease of £499 a week, and the remainder had changes both ways which left their wages eventually "as before." Thus the result of all the changes was an increase of £26,588 per week, compared with a net decrease of £9803 in the corresponding half of 1905. More than 300,000 coal miners had their wages increased between January and June of the present year.

HEATING & VENTILATING THE NEW OLD BAILEY.

The new session of the Association of Engineers in Charge was opened last Saturday, when, through the courtesy of Mr. Alex. Ritchie, the Chairman of the Lands Committee of the City Corporation, the members were afforded an opportunity of visiting the magnificent new building which has replaced the gloomy edifice which for so many years stood at the corner of Newgate Street and the Old Bailey. The features of special interest to them were the heating and ventilating arrangements, which have been carried out by Mr. William Key, who, as many of our readers may remember, was for some time Manager of the Tradeston Gas-Works of the Glasgow Corporation. The members assembled in the spacious hall which is approached from the principal entrance in the Old Bailey, where they were joined by Mr. Ritchie and several of his colleagues on the Lands Committee and a goodly number of ladies. Ascending the grand staircase, the company were directed to the largest of the Courts, where it had been arranged that Mr. Key should deliver a short lecture on the subject of heating and ventilation, with special reference to his system. Mr. Ritchie occupied the chair, and, having offered a few words of welcome, introduced Mr. Key, who at once proceeded with his discourse. He began by giving some particulars in regard to the building, which has been put up by Messrs. Holloway Bros. to the designs of Mr. E. W. Mountford, F.R.I.B.A., at a cost of about £400,000. It has a frontage of 287 feet to the Old Bailey, and is 75 feet high from the pavement level. There are, however, three storeys below. The height to the top of the statue of Justice surmounting the central dome, which is now a conspicuous feature among City buildings, is 212 feet. The main hall, from which rises the grand staircase, is 21 feet wide. Mr. Key explained that before erecting the building the site had been covered with portland cement concrete to a depth of 5 feet, so that there was no danger of its stability being affected by the adjacent tube railway or by any other underground works, while it was kept free from damp rising from below.

Mr. Key then proceeded to indicate the chief points in his method of ventilation, which is known as the "plenum" system, the principle of which is that of forcing in purified fresh air at a certain pressure, and providing means for conveying it away after it has become vitiated. He gave a demonstration in the Court in

which the company were assembled, all the seats in which, including those in the dock, are over air outlets. Placing a handkerchief over an air inlet, which was located at a fairly good height above the occupants of the seats below, the strength of the incoming current was made apparent. Then by means of a match burnt over the outlet in the dock the current of air was shown descending. A special advantage of the "plenum" system is that the source of the incoming air is known—none entering except through channels previously arranged; and the access of air from other sources is to a very large extent prevented by the greater pressure of that circulating within the hall or other apartment supplied. Moreover, the air is screened and washed before it is sent in, so that no smuts or flies—which are far more dangerous to health than smuts, inasmuch as they are germ-carriers to an alarming extent—can enter. The fresh air comes in slowly, but the vitiated air goes out quickly. It is changed once in every four minutes, and arrangements are made for ensuring a proper degree of warmth and moisture. Mr. Key claims for his system, which is in operation in several large establishments, that by its use every room becomes an isolation chamber—no air from it going into passage or corridor; indeed, he goes so far as to say that every individual occupant is isolated.

Mr. Key next gave some particulars of the plant installed by him in the basement of the building, which was subsequently inspected by the numerous company, including the ladies. The boiler-room, containing two boilers 30 feet long and 7 feet in diameter, the air-inlet chambers, the screening and washing arrangements, the engines and fans, and other portions of the plant, were examined with much interest, and any additional information required was afforded. There are four Westinghouse high-pressure engines, each driving two fans; steam-heated coils are provided to prevent the screens from freezing; and there is a coil at the base of every flue. The plant will send 600 tons of filtered and cooled or warmed air through the building every hour; and in this period will renew the air of four Courts fifteen times, without draughts. Before leaving the Court to make the inspection, opportunity was taken, on the proposition of the President of the Association (Mr. W. T. Hatch, M.Inst.C.E.), to accord a hearty vote of thanks to Mr. Key for his instructive lecture and for his explanation of the details of the plant. On emerging from the subterranean passages, the upper portions of the buildings were visited.

A MANUAL ON AMMONIA.

The fact that the best technical treatise on ammonia and its compounds—viz., that of Professor G. Lunge—is not published apart from the same author's longer treatise on coal tar, renders it somewhat less accessible than it should be to students of slender means. There are many engineers and chemists who have to deal with the working-up of gas liquor and the manufacture of sulphate of ammonia or liquor ammoniæ who are in no way concerned with the distillation of tar or the rectification of tar products; and it would be a great convenience to them also to be able to obtain Professor Lunge's standard work on ammonia apart from its companion work relating to tar. Yet, if we mistake not, the two works are inseparably associated in a single bulky, and necessarily rather costly, volume. This fact warrants the appearance of Dr. Grossmann's new manual, dealing solely with ammonia and its compounds,* in the compilation of which free use has been made of Professor Lunge's work.

Needless to say, Dr. Grossmann is a trustworthy guide to the student in so far as he quotes or follows Professor Lunge; but when he goes to other sources for descriptive matter, he is not always happy in his choice. He remarks that he knows how confusing the term "ounce liquor" is to the chemist; and with a view to making it clear, he proceeds to give an explanation extending over three pages, which is quoted *verbatim* from a book which primarily treats of gas-works. He would have been well advised to have taken an explanation from some other source, for the one given teems with inaccuracies, and is confusing in high measure. One degree Twaddel is represented as rigidly corresponding with two ounces strength; so that a liquor of 3 degrees Twaddel is equal to 6 oz. strength. One cubic foot of such liquor "weighs 1015 oz.; therefore it follows that in each cubic foot of liquor of that strength there are 15 oz. of ammonia in combination with 1000 oz. of water." Unfortunately for this delightfully simple explanation, a cubic foot of 6 oz. liquor, whatever its weight, contains only 13 oz. of ammonia, which, moreover, is combined with other bodies besides water. It would be interesting to know how Dr. Grossmann or his authority accounts for the missing 2 oz.

Generally speaking, however, Dr. Grossmann has been happier in his selection of authorities for quotation; and his compilation is not without much merit. It comprises 150 pages, of which the greater proportion is devoted to gas liquor and sulphate manufacture, though other sources and compounds of ammonia are also dealt with. The manual is, of course, not of the same calibre as Professor Lunge's treatise; but it is handier, and will be useful to students and others who have sufficient practical knowledge of the subject to be able to sift the sound from the unsound.

* "Ammonia and its Compounds." By J. Grossmann, M.A., Ph.D., F.I.C., &c., Chemical Engineer and Consulting Chemist. London and New York: Harper and Brothers; 1906.

ELECTRICITY IN GAS-WORKS.

By Chas. F. Botley, Assoc.M.Inst.C.E., of Hastings.

In contributing (by request) an article on this subject, which is becoming every day of more importance, the writer is struck by the change of attitude in regard to the question which has come over the gas world of late. Undoubtedly much of the change is due to the introduction of the De Brouwer and other machines for which electricity is peculiarly suited.

If electricity is used in gas-works, why is it? Surely not for any fad, but either because it pays to do so or on the grounds of expediency or convenience, as in the case of the De Brouwer, Toogood, Fiddes-Aldridge, and similar machines. But it does not necessarily follow, as is sometimes argued, that it will be equally advantageous for others to follow the example. The circumstances of a gas-works are peculiar and so widely different; the supply of current being under control, can be arranged as desired. Any works should be able to generate current cheaper than it can be purchased, unless, perhaps, when supplied by municipal speculators at ratepayers' risk or expense. To the writer, from his training and experience, it seems the most natural thing to convert gas by means of an engine and dynamo to electrical energy, if the power is more convenient in the latter form; and the design of the Glyne Gap works has, of course, been influenced by this fact. Electricity, it may be said, is not a primary power in the sense that gas and steam are.

In an editorial in the "Journal" for June 19 last (p. 755) several works (and there are others) were mentioned in which electricity is made use of, and more especially for power purposes. Time has not permitted, or the writer would have liked to have collated information on this interesting point; and if this article induces particulars, it will be an advantage. It is useful to know if the current is used for lighting, power, or both, and whether it is continuous or alternating current. It is improbable that there are at the moment any gas-works using other than continuous current, although for power two or three phase alternating current offers some advantages. Experience goes to show that, given the necessary combination of circumstances, even low (150 volts and upwards) currents are dangerous to life, and especially so with alternating current. It is therefore very necessary to guard against electric shocks, and to prohibit work being done on live circuits.

The question of when it is advisable to adopt electrical power will often arise, and opens a wide field for discussion. Every case will have to be considered on its merits; but the writer cannot quite conceive such conditions as will justify the purchase of current from an outside source, nor the constant generation of current for continuous running gas-works plant. To avoid misunderstanding, gas and electric works side by side under the same ownerships are not here referred to; and in connection with this it is well to bear in mind some general characteristics of a gas-works. There will be refuse fuel, which in large boilers with forced draught can be readily utilized for steam generation, and machinery more or less scattered—some running continuously and some intermittently. If a carburetted water-gas plant or similar apparatus is installed, ready means exist for the production of fuel or power gas. There will also be buildings and plant which have to be either lighted by some special external means, or by electricity; and, in passing, it may be remarked that electric wiring, &c., must be carefully installed where explosive mixtures may occur or exist. Although better than any naked flame, it is simply inviting trouble to rely upon the electric incandescent or glow lamp as absolutely safe any more than the wiring, especially in these days of high-pressure distribution. Single glow lamps can be used up to 250 volts.

Returning to the consideration of electrical power, the following very general statement (to which there will be exceptions) may be made. (*a*) For apparatus running continuously in the vicinity of the boilers—as the exhausters, for instance—steam is best. (*b*) For apparatus running continuously but away from the boilers—as pumps of various kinds—gas power is desirable. (*c*) For general stand-by plant or apparatus of moderate size running intermittently and not always simultaneously, and away from the boilers, electricity is convenient and useful. In regard to Class A, steam must be available on a gas-works; and it therefore is advisable to have sufficient steam plant to load the boilers advantageously, and have some outlet for breeze and other fuel. As to Class B, the economy is more marked when power gas is available; and all readers will be acquainted with the serious loss in efficiency in conveying steam long distances.

Class C is the important one now under discussion, and some details will be given in the description of the applications at the Hastings Gas-Works. Electricity can be conveniently distributed from a central point with but small loss, and for small or moderate size plant running intermittently, is advantageous. It is also particularly well suited for high-speed work, such as fans, centrifugal pumps, or the like. A word of caution is perhaps here necessary. In the writer's experience, it does not appear advisable to go from one extreme to the other and electrify all our power plant, although it is understood there is one works so equipped; and the profession will doubtless be favoured with particulars of this in due course. It is desirable for anyone who

contemplates adopting electrical power to have some personal knowledge of the subject, for disconcerting occurrences are likely to occur in the early days of an installation until the men who are employed have become accustomed to the new conditions. The writer does not, of course, here refer to the small engine and dynamo installed to drive retort-house machinery, but to the general application.

To those unacquainted with motors, a brief description may be interesting. There are series wound, shunt wound, and compound wound continuous current motors—each class having its special application—and open protected, semi-enclosed, or totally enclosed, as the case may be. Series motors are used chiefly for traction work, capstans, cranes, &c. With shunt or compound motors, and semi or totally enclosed, we shall here be mainly concerned. On a gas-works most positions will need wholly enclosed motors, which are, as far as practicable, dust proof and gas proof. Some motor manufacturers allege that coal dust has a deleterious effect on the insulation—certainly it is very undesirable within a motor—and it will be obvious that sparking at the commutator might fire a gaseous mixture. Hence the precaution of completely enclosing. Such motors, however, need to be of liberal rating, as they will get very warm at work, especially on long runs. Shunt-wound machines run at constant speed with constant voltage; and compound-wound, more or less so. The writer has a preference for the latter on apparatus with much inertia, such as coal-conveyors; for the starting-up current is not so heavy, and there is capacity for overload. [The starting-up current may momentarily be double the full load working current.] Shunt-wound motors are very general for handling a varying load at the same speed; and, where speed regulation is desired, they are essential. Motors will drive through machine-cut gearing or belting, according to circumstances; and the speed question can often be dealt with in this manner, for it is the writer's practice to avoid speed regulation wherever possible. When this becomes needful, however, among other methods, there are motors of special design, giving an adjustment of 6 to 1 in speed without sparking.

It is well to instal motors only of well-known make, and in standard sizes, so as to keep the necessary spare parts at a minimum. They will have an efficiency of 85 to 90 per cent. In these days of keen competition in all directions, the power of motors is apt to be viewed liberally by the makers, and care therefore needs to be exercised; for a too small motor or starter for a load will never be satisfactory. An electric motor is essentially a high-speed machine, and consequently slow speed machines are more expensive as compared with high speed. It will also be understood that it is easy in pioneer work to underestimate the power needed to drive particular apparatus.

Every motor panel or switch board must have a double pole main switch, a circuit breaker or double pole fuses, and starting switch. If speed regulation is required, the latter will be replaced by a regulating switch, and an ammeter (current measurer) is useful. The writer also adds pilot lamps, which indicate when the current is on and roughly the voltage (pressure). The D.P. switch should always be used to stop the motor, and disconnect same from circuit. Before closing it for starting, it is a necessary precaution to see the automatic arm of the starter is back in its "off" position. The starter should be fitted with an adjustable overload cut-out and a "no circuit" release. The first will often save the motor and fuses; and the latter, in case of a failure of current, disconnects the motor, for it has to be appreciated that putting current on a motor before it is running or excited gives a dead short circuit. In the ordinary way, the panel will need enclosing in order to avoid shocks, to prevent interference, and to protect it from dust.

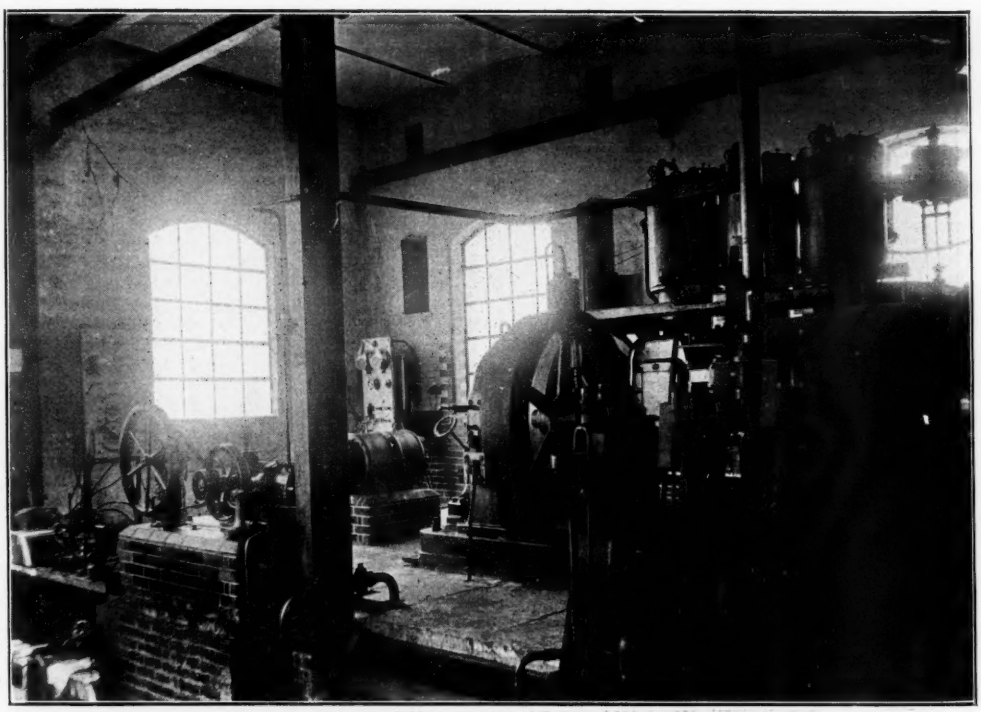


Fig. 1.—Westinghouse Gas-Engine and Dynamo, with Accessories in the Machinery-House.

In regard to the care and maintenance of electric motors in constant use, more skilful attention to details is necessary than is the case with gas-engines, even when the former are installed with every consideration for their success. Unless impracticable, it is the writer's practice to start up motors light—so that, before stopping, coal-conveyors or the like are run empty, or the belt put on the loose pulley—and also to have all motors frequently inspected by a trained mechanic. Starting up a motor is simple enough; but there is a personal element in it, and carelessness will cause some trouble. It thus pays to instruct men properly under definite instructions. Men so trained will be quick to note any irregularity, and by reporting same may perhaps save a breakdown. Fuses or circuit breakers should not be interfered with by unqualified men; and it is wise to investigate the cause of any seasoned fuse blowing before renewing. Increasing or loading-up a fuse is akin to adding weight to a boiler safety-valve. The chief wearing parts of a motor are the brushes and commutator; the former being readily renewed or rebedded from time to time. Coal dust, grit, or the like will render this needful, also causing wear (recessing) of the commutator, which can only be remedied by re-turning. Motors and switches cannot be kept too clean (which is not easy in the presence of coal dust) and must be efficiently earthed.

It was in 1894, when the naphthalene question was being investigated, that electricity was introduced on the Hastings Gas-Works; permission being granted the writer for a small installation, which was carried out by the Company's own men, consisting of a small Brush dynamo (65 volts) belted to a Fielding and Platt gas-engine, with storage battery, &c., &c. The battery was charged in the usual way in the daytime, and discharged at night, but this is an inefficient way, although convenient, and especially useful for testing glow lamps, &c., giving a steady current. To meet increased requirements, and to keep pace with electrical progress, modifications have been made from time to time, till at present current is chiefly supplied from a 10 kilowatt set, comprising a P.E. horizontal engine by Crossley, coupled direct to a Crompton dynamo running at 250 revolutions per minute. It would be difficult to speak too highly of the performance of this set, which has now been in use since 1900. It runs during the hours of darkness with only periodical attention; and the repairs have been infinitesimal. Regulation and reliability have been alike admirable, and it could be let out on hire with confidence. Supplied to specification, the dynamo is shunt and compound wound, working up to 250 volts as a shunt-machine and at 224 volts compounded. The gas consumption on light load is 40 cubic feet per Board of Trade unit generated, and under 30 cubic feet on heavier

load. When first installed, current was supplied to the works on the three-wire system, with 110 volts on either side of the middle wire; but lately the supply has been direct at 220 volts. The lower voltages have the great advantage that much better glow lamps can be obtained than for higher pressures. Current is distributed by a pair of insulated 19-16 cables by Siemens and Co., carried overhead on specially-designed insulator supports. These cables have now been in position over ten years, and have been entirely satisfactory; nothing having been done to them beyond occasionally coating with some protective paint.

Electricity is used for lighting the carburater, meter, valve, and governor houses, the oil stores, purifiers, and elsewhere for testing and educational purposes, as power for syphon pumps, and in the carpenter's shop. In the latter case, the motor is shunt-wound 10 brake horse power for 230 volts, totally enclosed, and works the planer and 36-inch saw alternately; but it is none too large for the latter. A gas-engine would have been used, but that the work is occasional, and space valuable; so it was decided to run the gas-dynamo when necessary and use electrical power. This same motor has been used for some experimental work; and it may be useful to state that, working a small exhauster passing about 34,000 cubic feet of gas per hour against 24 inches pressure, the power needed was 4·5 brake horse power, and the gas used in the dynamo engine 0·5 per cent. of the quantity exhausted. Also running rather above normal speed, a Holmes scrubber-washer and a Kirkham scrubber-washer took 6·4 and 5·9 brake horse power respectively.

This installation at the Hastings Gas-Works has been of great utility. The repairs of a station meter drum *in situ* were possible, and the alteration and extension of a gasholder were assisted and expedited by its aid. With flexible plug lines (instead of hand lamps), the internal examination, cleaning, &c., of gas plant are facilitated; but it is not wise to use glow lamps in places where good old candles or gas would render the presence of carbonic acid gas apparent. In these days of keen competition, too, the advantages of personal knowledge from practical tests of all the latest form of electric lamps and appliances will be manifest; and such tests are being constantly made.

Readers will no doubt be acquainted with the general lay-out of the Glyne Gap works from the illustrated descriptions in the "JOURNAL;" and it will now therefore suffice to point out that concentration of the power supply plant in a position as centrally situated as possible is a feature of the design—the boilers being advantageously placed in relation to the steam-using plant. The electrical installation is at present incomplete; but the plant already installed forms part of a general scheme. There are two 55 kilowatt generating sets (90 brake horse power), one steam driven and one gas driven, the dynamos being identical and interchangeable, made by the Westinghouse Electric and Manufacturing Company for an output of 100-120 ampères at 450-500 as shunt machines, and 500-550 ampères as compound. The steam set (Photo. No. 2) is really a stand-by unit, or for use in case there is surplus boiler fuel. Having the boilers, the outlay was less than for another gas dynamo. The engine is a slow-speed compound, built for 150 lbs. pressure by Messrs. Davey, Paxman, and Co., of Colchester. The gas-engine (see Photo. No. 1) is a three-

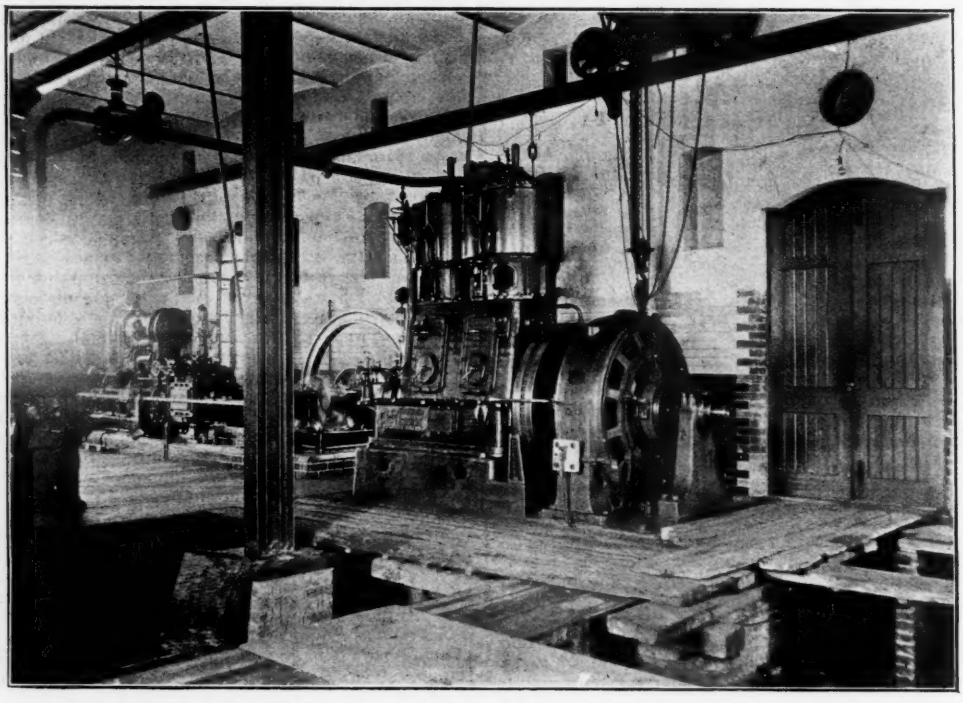


Fig. 2.—Davey-Paxman-Westinghouse Steam-Set in the Machinery-House.

cylinder vertical Westinghouse for producer gas or coal gas. It is governed on the regulation of mixture principle, and when in good running order handles the power load, which is more exacting than the ordinary lighting load, admirably. At present, coal gas (calorific value, 560 to 570 B.Th.U. net) is used; and the works cost for current is under ½d. per unit, and will be less when power gas is employed.

Each dynamo has a switch board or panel of the Westinghouse standard type placed near by, as can be seen in Photo. No. 1, and connected up with fireproof insulated cable thereto. The fittings are as follows: Voltmeter and key, pilot lamp, ammeter, shunt regulator, double pole main switch, and auto-circuit breaker on the negative side. The last named is very reliable, and, if adjusted close, it minimizes the risk of damage from carelessness on the circuit, and takes the place of the ordinary fuses. These various panels will be eventually assembled on one switch board. The sets at present are run (at 475 volts compound) as separate units; but provision is made for running in parallel, in which case the current output capacity is increased. In the ordinary way the plant is shut down for meal hours, and is only run at intervals at night. Under such conditions gas power is ideal, especially as the engine can be readily started by the aid of compressed air. The cost of the installation to date, apart from motors identified with any particular machine or contract, has been £2500. Any additions to the generating plant will be gas driven.

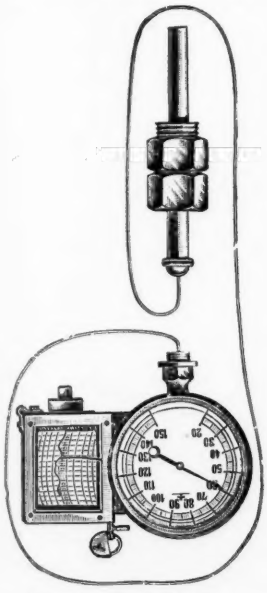
In planning an installation, the pressure of supply and the size of units of plant need to be carefully determined. At present 220 volts is looked upon as a standard pressure, and is generally very suitable—a higher pressure being adopted at Glyne so as to be in a position to supply, if need be, current to trams, &c., in the vicinity. But incidentally this effects a saving of copper in the conductors. On the other hand, the higher pressure is some disadvantage for small motors or glow lamps; and the latter either have to be used two, four, or five in series as the case may be. To obviate difficulty on this account, the three-wire system is arranged for; and on reference to the photograph of the gas set, a balancer will be seen to the left of the same. By means of this, single glow lamps or motors of 220 to 250 volts may be run off either side of the middle or third wire; the balancer keeping the pressure on either side due to the varying load even. The balancer switch-panel with the various instruments and switches in connection, can also be seen in the photo., further to the left-hand side.

(To be continued.)

The following results of a test made by the Mechanical Engineering Department of the Iowa State College upon a producer gas-engine plant in the municipal lighting station at Algona, Iowa, are taken from the "American Machinist." The engine is a vertical three-cylinder one, rated at 150 brake horse power at 250 revolutions per minute. When the engine was developing 40·1-horse power, 1·511 lbs. of anthracite pea coal was used per brake horse power; at 82·7-horse power, the consumption was 1·157 lbs.; at 156·9-horse power, it was 0·999 lb.

MODERN TESTING APPLIANCES AND METHODS.

ANYONE who has paid a visit to the Page Street works of Messrs. Alexander Wright and Co., Limited, must have been struck with the fact that, while admirably adapted for manufacturing purposes, yet they furnished the visitor with little or no opportunity of seeing the finished apparatus made there. This has now been remedied by the opening at No. 1, Westminster Palace Gardens, Artillery Row, Victoria Street, S.W., of a suite of showrooms, which we have taken an early opportunity of visiting. It can be said at once that what we saw there gives one the pleasurable task of placing on record an impression of the great advance made by the firm, and of the fact that invention and ingenuity in the department of testing apparatus, at any rate, are holding their own in this country.



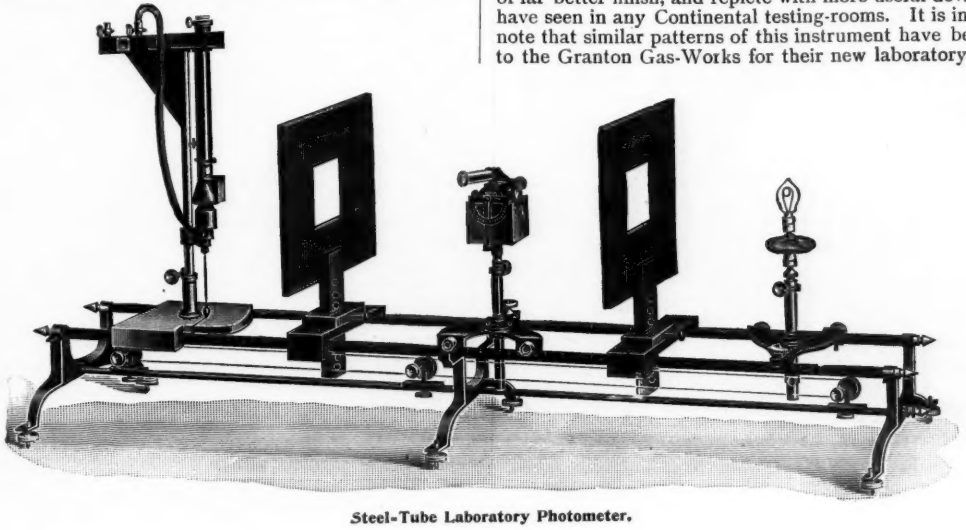
Recording Pyrometer to 1000° Fahr.

Simmance—Abady "Co_2mbustion" Recorder.

Simmance-Abady Flue Draught Indicator.

At the first glance, it is obvious that the whole scope of the business has increased and its trend altered, moving from what we once called "the cult of the gas examiner" to the application of science to manufacturing industries. For instance, boiler-house equipment was certainly at one time out of the firm's field; but now it forms an important part of the business, as is evidenced by the large collection of useful apparatus bearing upon fuel economy. Pyrometers of high and low range—optical, recording, and indicating—in forms for application to boilers, furnaces, flues, economizers, feed-water heaters, vats, and various other industrial purposes, are to be seen there. Steam-pressure gauges and recorders, flue-draught indicators and registers, calorimeters for gases and solids; and, in fact, everything that is required in the most up-to-date boiler-house has a place in the show-rooms. More especially must we mention the apparatus for recording the percentage of carbonic acid in flue and other gases. This is the latest of the Simmance-Abady patents, and is claimed to be the only exact instrument of its sort on the market, as the inventors state that not only is the volume of gas analyzed, measured off with absolute exactitude, and reduced to uniform pressure, but the absorption process is entire, and the great difficulty hitherto unsurmounted—*i.e.*, the dispersal of the heat of the chemical combination of carbonic acid with the caustic potash is overcome, so that the record of carbonic acid agrees absolutely with the most careful laboratory analysis, and is obtained without attention. It is named the "Co_2mbustion" recorder.

In the photometrical department especially, the changing of the old order of things is noticeable though there are still to be seen several patterns of the standard Letheby bunsen photometers of Wright's well-known form, and with the porcelain apparatus. The increasing demand for photometers for general technical purposes—more especially for electric light work—has produced a type of photometer free from the trammels imposed by the Gas-Works Clauses Act. The new types appear to have entirely abandoned the wooden bar, which has had to give way to steel. Indeed, the photometers (as will be seen from the illustration) resemble more the Continental type, but appear to be of far better finish, and replete with more useful devices than we have seen in any Continental testing-rooms. It is interesting to note that similar patterns of this instrument have been supplied to the Granton Gas-Works for their new laboratory, and to the

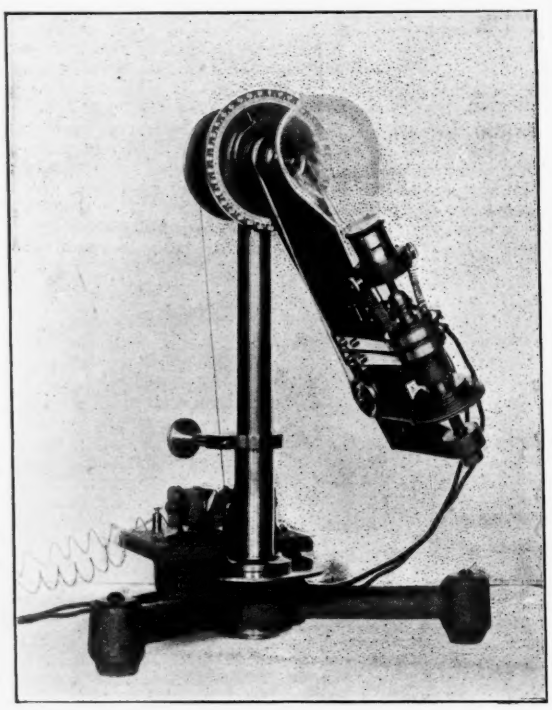


Steel-Tube Laboratory Photometer.

Simmance-Abady Resistance Panel.

Armstrong College, among others; while the Simmance-Abady "Flicker" photometer head has found universal acceptance. The same type of bar construction has been adapted to what seems an ideal arrangement of "open-bar" photometer, with a fixed Carpenter No. 2 Metropolitan burner, the Harcourt 10-candle standard lamp, and a moving disc box, while the readings are taken with the observer seated. Here we have a photometer which will test incandescent burners up to 1000 candles, and with a subsidiary scale marked in bold figures, black upon white, for use in official gas tests, of from 5 to 25 candles. All the essential features of the Referees' table photometer are reproduced without any of the disadvantages so justly complained of. Readers of the "JOURNAL" who have interested themselves in the articles we have given descriptive of the up-to-date gas-works of the Tottenham and Edmonton Gas Company, and in their complete modernizing Act of the past session to which we have frequently referred, will be further interested to learn that Mr. A. E. Broadberry, after much consideration, has, in conjunction with the Local Authorities, adopted this new "open-bar" photometer for official tests both at the gas-works and the public testing-station.

Continuing our examination of new photometers, the suggestion occurs to one that gas engineers who wish to know what the electric light people in the district can accomplish might do worse than get particulars of the attachments—such as the Simmance-Abady resistance panels, which, added to their photometers, would enable them to test for themselves the light that their competitors have to offer. By these panels, lamps can be adjusted to practically any voltage by a fine series of resistances, and the ammeter can be cut out, as also can the voltmeter, or both can be applied so as to not only record the pressure or voltage, but also to give the actual current consumption of any lamp under test. The Simmance-Abady street photometer is ingeniously constructed; and for it it is claimed that it enables the actual illuminating effect to be taken in any part of the street in as accurate a manner as one could well desire.

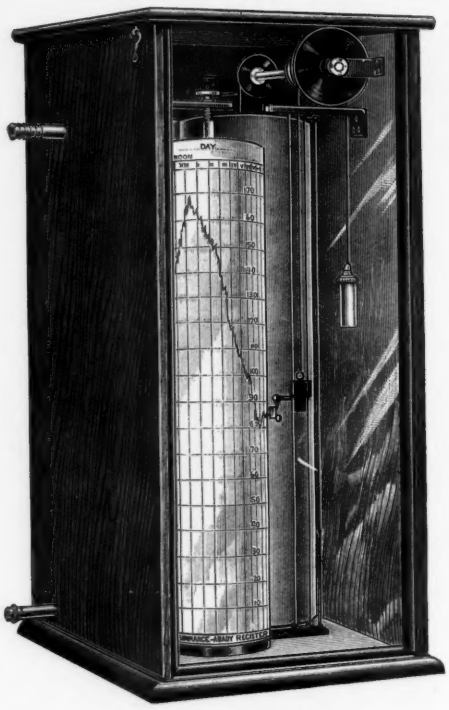


Testing Electric Light at Various Angles.

Standards of light are, of course, well represented in the showroom—pentane, electrical, and paraffin; this latter being Dr. Elliott's kerosene standard, which we described and illustrated in the "JOURNAL" for May 29 last (p. 578). This standard has been submitted by Messrs. Alexander Wright and Co. to the National Physical Laboratory; and it is interesting to reproduce the report on it, signed by Dr. R. T. Glazebrook:

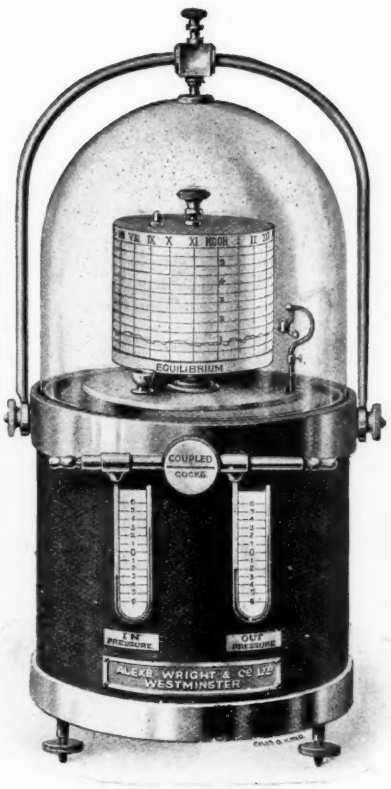
With reference to Dr. Elliott's lamp, on which you ask for a preliminary report, we have pleasure in giving you the results of our tests up to now, and shall be glad to hear if these are satisfactory for your purpose, or whether we shall continue our investigations further.

The lamp was set up and fitted with a wick, charred and adjusted according to the instructions sent, and photometric comparisons made against a constant source of light. The flame was adjusted in height until a maximum illumination was obtained on the photometer; this point occurring when the flame was about $\frac{3}{8}$ inch to $\frac{1}{4}$ inch above the back edge of the screen. If the mean height of the flame is either $\frac{1}{2}$ inch or $\frac{1}{8}$ inch above the edge, the candle power will be lowered about $1\frac{1}{2}$ per cent. The first reading gave 10·03-candle power. The lamp was then left and tested the next day with same oil and wick – candle power, 10·23. A new wick was then prepared and inserted, and gave 10·06 candles. After 48 hours, the same wick was used again, giving 9·26-candle power. During the first three readings, the humidity was constant at about 13 litres per cubic metre; on the last occasion, it had fallen to 11·7. But we do not think the evidence is sufficient to attribute any change there may have been in candle power to variation in humidity. The presence or absence of ventilation did not seem materially to affect the lamp as far as our experiments went.



Simmance-Abady Register.

Registers of gas pressure form a very considerable part of the exhibits, and range in scale from 100th of an inch to 30 inches. We are informed that the demand for these higher scales is fast increasing, as the distribution from station to station under high pressure becomes more general; and the fact that the Gaslight and Coke Company and the South Metropolitan Gas Company are using the types manufactured by the firm is a sufficient guarantee of their reliability. The neatness of the design of the Simmance-Abady register is evidenced by the fact that a register to show 30 inches on a full size scale only measures 34 inches in total height. An ingenious register is shown for recording the loss of pressure in purifiers, scrubbers, and similar pieces of gas plant. Thus, if the inlet pressure is 8 inches, and the back-pressure reduces it to 6 inches on its outlet, then this register marks the difference of 2 inches on the chart. This will supply a very useful check upon gas-works apparatus.



Simmance-Abady Differential Recorder.

A large collection of test meters is shown, of various capacities—on both the metric system and in cubic feet. With these, amounts of gas from $\frac{1}{100}$th of a cubic foot to 1000 cubic feet are accurately measured and indicated; while the adjustable stop-action enables the total amount to be passed to be previously arranged and exactly indicated, without any attention. The question of destructive vapours, dirty gas, &c., is dealt with by the provision of suitable non-corrodible materials for the cases, drums, and fittings of these meters. An idea of the thorough manner in which the firm deal with the question of registration of gas pressure and measurement of gas volume may be obtained from the statement that the regular stock patterns of registers made by them number no less than 90—all of different scale or application; while the stock patterns of meters number 38, all being of different capacities and indications.

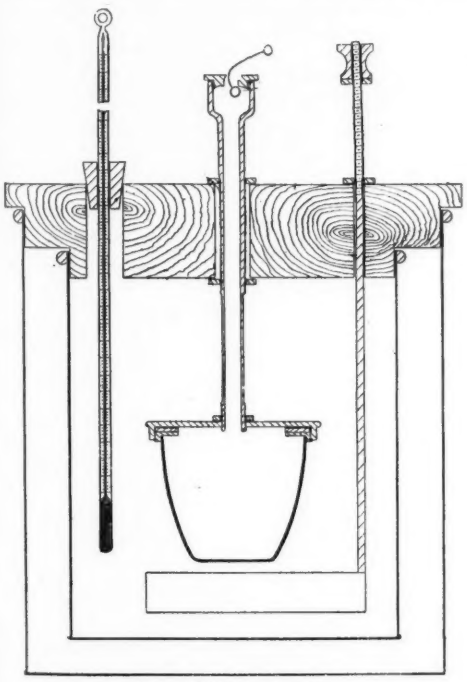
The selection of pressure-gauges embraces those with 48-inch scale, mounted in batteries down to a little 3-inch pocket gauge. What specially struck the writer was a "detachable" gauge, in which the loosening of a single nut enables the glass tubes to be withdrawn and replaced with a certainty of absolute soundness, and thus a complete avoidance of the troubles which all gas managers have to put up with in replacement of gauge glasses is effected. Gas calorimeters—both Boys and Simmance-Abady—are, of course, on show, and are fitted up so that inquirers can see tests actually made. A method for using the calorimeter in testing a suction-gas plant was described to us; and this gets over the hitherto existing difficulty of drawing samples of gas which exactly represent that which the engine is taking. A record of some of these tests should certainly open the eyes of gas managers who are troubled by the incursion of suction plants in their districts. The importance of a knowledge of the calorific value and the evaporative power of coal was mentioned earlier in this article. We do not think the tests for these qualities could be carried out in a simpler manner than by the new Roland Wild calorimeter, of which the firm are the sole makers. It is a cheap little apparatus, so simple that one might almost use the traditional phrase "press the button, and the figure does the rest."

Messrs. Alexander Wright and Co. seem to have thoroughly dealt with the supply of ordinary laboratory glassware, thermometers, chemical balances, gas analysis apparatus, chemicals, solutions, &c.; and in connection with glassware, we must make special mention of a set of apparatus for rapidly testing for carbon dioxide, sulphuretted hydrogen, and ammonia in gas at all stages of manufacture, which includes an ingenious gas bottle devised by Mr. T. S. Lacey. This is arranged to ensure that a dry sample of gas is dealt with. Any error due to the absorption of ammonia, for instance, by water is thus avoided, and the tests are of the simplest nature.

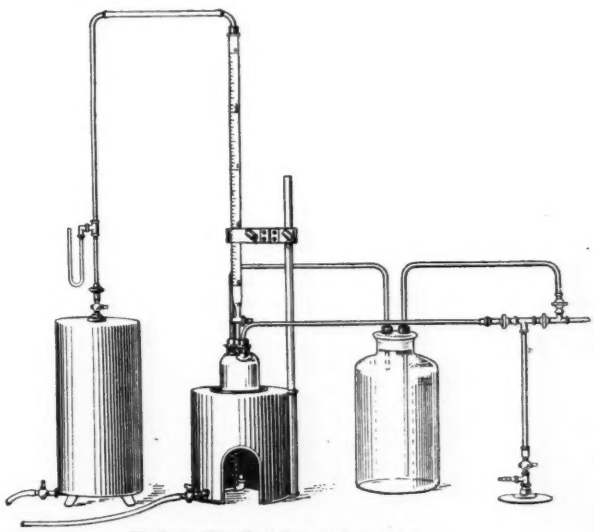
Messrs. Colman and Smith's naphthalene test is also to be seen; and it appears that, from the vogue of this apparatus, it may almost be looked upon as the standard test for estimating naphthalene in gas.

A handy attachment to the photometer for testing the enrichment value of light oils (benzol, carburine, and the like) is due, we were informed, to Mr. J. G. Taplay; and, from the illustration, it will be seen that the amount of oil per cubic foot of gas can be regulated to a nicety, and the rise in candle power instantly tested on the ordinary photometer.

We have said enough to show that a most interesting and up-to-date selection of testing apparatus covering a very wide field of practical utility is now made by Messrs. Alexander Wright and Co. To visit their show-rooms is an educational treat to the gas engineer, and to all whose business it is to economize in the power departments of industrial establishments whatever the nature of their work.



Roland Wild Calorimeter.



Taplay's Gas Enrichment Apparatus.

Manchester and District Junior Gas Association.—We learn from the Hon. Secretary (Mr. A. L. Holton) that the annual general meeting and smoking concert will be held at Tyldesley on Saturday, the 20th inst., when the President-Elect (Mr. R. H. Ginman) will be pleased to entertain the members at tea. In the afternoon a visit will be paid to the Tyldesley Gas-Works, by the kind invitation of the Tyldesley-with-Shakerley Urban District Council and Mr. Ginman, their Gas Engineer and Manager. During the past few years a large amount has been spent in the reconstruction of the works, and the points arising therefrom will be fully explained, both at the works and in Mr. Ginman's Presidential Address.

NORTH OF ENGLAND GAS MANAGERS' ASSOCIATION.

Half-Yearly Meeting at Newcastle-on-Tyne.

The Fifty-Ninth Half-Yearly Meeting of this Association was held in the Lecture Theatre of the North of England Institute of Mining and Mechanical Engineers, Newcastle-on-Tyne, on Saturday. Mr. T. HARDIE, the President, was in the chair.

NEW MEMBERS.

The minutes of the previous meeting having been read and confirmed,

The HON. SECRETARY (Mr. Herbert Lees) reported that three proposals for membership had passed the Committee. These were that Mr. Frank H. Kaye, Gas-Works, Richmond, Yorks., and Mr. Robert Watson, Gas-Works, Doncaster, should become members; and that Mr. Reginald W. Copeland, Lamp Superintendent, of Newcastle-on-Tyne, should become an associate. The recommendations of the Committee were unanimously adopted.

The PRESIDENT then delivered the following

PRESIDENTIAL ADDRESS.

Permit me to express my appreciation of the honour you have done me in electing me President of your Association for this year. I scarcely feel equal to the duties that devolve upon me in this office—more especially when I remember that, not only should I maintain the high standard set by previous Presidents, but also that the abilities of officials of the Newcastle-upon-Tyne and Gateshead Gas Company, who on two former occasions have held this office, may have led you to expect from me more than I am capable of imparting.

It is seven years since the Chief Engineer, Mr. W. Doig Gibb, was President of the Association. Seven years is only a short period; but it has been a most important one in the annals of the Newcastle Gas Company, as during that period they have had to contend for business with probably the most progressive Electric Supply Company in this country. Mr. Gibb was right when he then said "that the struggle in the future will be even more severe than it has been in the past." The competition has been keen; but, on this Company's part, they have been glad to have had it. It has been a benefit to their consumers; it has been a benefit to the Company themselves. The department over which I have charge has had nothing, except indirectly, to do with meeting this competition; and therefore I am taking no credit to myself when I say that it has been the means of showing that the Gas Company of this city had Directors and other officials capable, not only of meeting it, but of doing so in such a manner that the Company to-day are in a stronger position than ever previously, and the increase in gas consumption has been greater during the last six months than it has been for five years.

What I have said of this Company, practically applies to the gas industry as a whole. Throughout the country there have been signs that gas is more than maintaining its own, and that the general public continue to recognize that for lighting, heating, and power, coal gas is the most efficient and most economical commodity. This end has been reached by energetic action on the part of the officials of gas undertakings; but it has only been rendered possible by those makers of gas appliances who, by their readiness of apprehension and judicious application of knowledge, have most successfully supplied them with apparatus of such a type that, no matter in what direction the gas is to be applied, greater efficiency—to the extent of very many times the value of that which was possible only a few years ago—can be got out of it. Further important assistance has also been given by those inventive geniuses who have in so many ways improved the plant used in the manufacture of gas; so that, notwithstanding the large increase in the price of coal and all other materials used, gas is made and sold as cheaply to-day as at any period in its history.

Having referred to the presidency of Mr. Gibb, permit me to take you back to the year 1885, when my late father had the honour of presiding at your meeting. In the 21 years that have passed since then, many changes have taken place in the Association; but we still have among our active members, not only some who were present on that occasion, but also those who can go still further back, to the formation of the Association eight years previously. Much as I should like to refer to some of those changes, I refrain from doing so, as I feel I am not capable of dealing with them as they ought to be dealt with. But I hope that one of the early members of the Association may some day favour us by once more becoming our President, and by taking the opportunity to give us some of the reminiscences connected with it, which I am sure would be greatly enjoyed by even our very youngest member.

There are in that Inaugural Address of 21 years ago references made to one or two matters which even to-day are of interest; and to these I wish to draw your attention. Allusion was there made to the fact that the Newcastle Gas Company had that year been fined £10 for having in their gas over 20 grains of sulphur per 100 cubic feet. I believe it was the first and the only time that the Corporation of Newcastle have dealt so hardly with the Gas Company, and that only on one other occasion since has their Examiner reported an excess in the statutory number of grains of sulphur in the gas. In July of this year, as you are aware, the Company, along with some fourteen others, were freed from the sulphur restrictions (other than those relating to sulphuretted hydrogen), under which they had worked for 42 years. These restrictions are now practically obsolete, as there only remain about twenty statutory gas undertakings out of a total of 750 in Great Britain subject to any restrictions whatever in the quantity of sulphur compounds other than sulphuretted hydrogen, and in about half of these the restrictions are a dead-letter. It is needless for me to say that the removal of these restrictions has been a relief to the management. But I would add that the policy of the Company has not changed. As under the old arrangement they produced a gas to meet the requirements of their then existing Acts, and to give satisfaction to the consumers, so under the new arrangement they will take advantage of nothing in the Act that will prove in the slightest degree detrimental to any of the consumers, no matter to what class they may belong.

Another reference in that address of 1885 was to a recent reduction in the price of tar, and the advisability of making use of it in other ways so as to increase its value. This subject has been brought into prominence again recently by Sir George Livesey. There are undoubtedly channels for the disposal of tar, other than those for the purpose of distillation; but its usefulness in other directions would unfortunately seem to depend at present on its price being at rock-bottom, and consequently the benefits accruing are practically *nil*. How we are to take advantage of the consumers of the smaller quantities to raise the selling price to the larger consumer, and still to keep the price low to the former, is a question which I leave to our commercial men to determine.

In the year previous to 1885 an attempt had been made to bring Local Associations into closer union with the Gas Institute. It is some satisfaction to know that this thorny question, at any rate, has been at last settled by the amalgamation of the Gas Institute and the Institution of Gas Engineers, and by the affiliation of the District Associations with the combined body, and that outside Scotland, where I believe the matter has been taken to "avizandum," its consideration will not trouble us further.

Notwithstanding all the changes that have taken place, and all the progress that has been made, we thus find many questions having practically the same interest at the end of a quarter-of-a-century as they had at the beginning. Though this is so, there are many changes that have been both real and fundamental, and progress has been rapid and substantial. It is probably in the retort-house that greatest and widest differences have been made in manufacture. Reconstruction has for some years been the order of the day.

The rapid evolution of different methods of charging and discharging retorts during recent years has proved most bewildering to all gas engineers who are in any degree anxious that their retort-house results, both as regards output and cost of production, should be the best obtainable. They were only beginning to form a definite opinion as to the comparative advantages of slopers and horizontals charged by machinery, when they were forced to consider the relative superiority of machines capable of dealing with 20-feet retorts from one side only, over those with which they were becoming familiar; and before this has been settled, they have had brought before them a machine for both charging and discharging at one and the same time, besides a variety of settings where the retorts are placed vertically.

These latter seem to be attracting most attention at the moment. It is thought by many that in some system of vertical retorts will be found our final goal. If only the labour necessary in the work of charging and discharging retorts had to be taken into account, the vertical retort should certainly stand first. Our business is to make gas, however, and to sell it as cheaply as possible; and a saving on present labour charges may be quickly lost if the quantity or value of any of the products of the carbonization of coal is reduced. There are several methods of carbonizing in vertical retorts—the coal may be charged into the retort in small quantities almost continuously, in large or small quantities intermittently, or in a full charge all at one time. Experience only will show if any of these methods will produce results equal to, or better than, the present method adopted in horizontal and sloping retorts, of laying the coal in a fairly thin layer along the whole length of the retort. Of course, there are thousands of tons of coal carbonized every week in this district in coke-oven plants by the method of placing a full charge in an oven, which for all practical purposes may be considered just a huge retort. Coke-ovens, compared with gas-retorts, produce per ton of coal used more coke of better quality, and less gas of poorer quality. In the newer systems, the gas has an illuminating value of 10 candles or thereabouts, and a net calorific value of 500 B.Th.U. Some 70 per cent. of the total quantity produced is used for heating the ovens, and the balance is in most cases wasted. The method largely in use in the United States—of having two hydraulic mains to the bench, into one of which the rich gas evolved at the beginning of the distillation is passed and used for illuminating purposes, and into the other the later and poorer gas for heating the oven—has not, so far as I am aware, been adopted anywhere in this country. On the face of it, it would appear that it would be advantageous

for a gas company, situated in a coking-coal district, to work on the coke-oven system, as, under such circumstances, the additional revenue from gas sold should enable a very handsome profit to be made.

The success attained by Mr. A. Wilson, of Glasgow, with outside producers has induced the Newcastle Gas Company to make a trial of them at their Redheugh works; and they are now building there three producers, of the same design as those at work at Glasgow, which will heat ten ovens of nine through retorts. Owing to the design of the retort-house in which this bench is situated, it has previously been possible to heat the retorts by means of only very shallow generators; and the necessary rebuilding of the bench was thought to be a favourable opportunity of testing the adaptability of outside producers. The difficulties with outside producers have always seemed to me to have been mostly confined to clinkering; very considerable labour having previously been necessary in carrying out this work. With Scotch coke, the adoption of the Duff grate by Mr. Wilson appears to have removed this difficulty altogether; and a trial of Durham coke with the grate has given equally satisfactory results. Very great outlay has been made in altering from one method to the other; and considerable saving in labour costs and fuel used is required of the new system to repay this outlay. On some future occasion perhaps I may have the pleasure of relating to you my experience in this respect.

While on this point, I would say one single word of caution. It is quite possible to be enticed into making some comprehensive alteration or extension through learning by figures—published or otherwise—of the wonderful saving that has been effected elsewhere by the adoption of some other system than our own. It is well to ascertain very carefully whether such saving has not been made possible by some very inferior and bad working previously. Further, figures often only show the saving, and not the loss. Generally they are published before there has been time to discover what are the losses. There is undoubtedly a tendency at the present time, fostered in the first instance by the wish to produce gas more cheaply, and in the second to be quite up to date, to expend large amounts on plant and machinery, on which a satisfactory return is very problematical. After having once decided on the adaptability of any fresh system to the particular works over which we may have charge, too much care cannot be expended in considering, not only its advantages, but also its disadvantages, before recommending its adoption. Not that I wish to discourage alteration of method or the use of machinery. My own experience has been mainly—though not wholly—favourable to so doing. At the Redheugh works, by the introduction of stoking machinery, for instance, no less a sum than £12,000 is saved annually, and not only so, but, by the same means, the output of the retort-houses has been increased 20 per cent.

It is not my intention in this address to deal with contentious matter; but I wish to give you to some extent what has been my own experience with respect to certain systems of stoking machinery with which I have worked. In 1899, there was introduced at Redheugh a system of West's compressed-air machinery, which was so successful that it was extended to a second retort-house in 1900, and to a third in 1902. At the beginning of this year there was placed in a fourth retort-house an installation of Jenkins-De Brouwer charging and discharging machinery, which has been working only some six months. I will endeavour to put before you some of the advantages and disadvantages of these systems, as I have found them, without making any distinct comparisons, which would be better dealt with in a paper open to discussion, and which, indeed, my limited experience with the De Brouwer machinery would not justify me in formulating.

Perhaps the most important point to consider in regard to any system of retort-house machinery is its reliability. With respect to this, I have worked one set of West's machines continuously for six years, most of the time on 24 beds of nine retorts, and at no time on less than 12 beds, with losing not more than one or two charges during the whole period, and without on any occasion having resource to hand labour. Of course, credit for this is very largely due to the careful attention of fitters, the possession of plenty of spare parts, and fair treatment of the machines by their workers. But all these together could not have produced so excellent a result if the design of the machinery had not been admirable, and the material good and ample. A shorter experience with the De Brouwer machinery has not proved quite so satisfactory. The charger has given no trouble; but the pusher has caused some delays. Alterations have already been made in the latter; and I have no doubt another season will show a decided improvement. In making this comparison, let me remind you that, at the time we put in the West machines, they had been working at many places for several years; and consequently their faults had been found out by others and remedied before we adopted them. This is not so with the De Brouwer machines—more especially the discharger, which is still only in its infancy; and a little experience has already enabled the makers to introduce valuable improvements.

There is, however, a rather important matter pertaining to the use of the De Brouwer machines, and all other systems in which the coke is discharged by pushing. It is that to a very considerable extent the pusher is dependent, for its proper working, on the work done by the charger. That is to say that, unless the man working the charger lays a regular and even layer of coal in the retort, it is probable that the pusher will refuse to clear the coke properly from it. This is part of our trouble, and is largely due to the inexperience of the men. Coals are, moreover, of different consistencies. One coal is quite rough, with little dust among it; and another is comprised almost wholly of small, with a large percentage of dust. If the belt of a De Brouwer charger is running at a constant speed, a very much longer time is necessary to pass a definite quantity of the former than is required to pass the same quantity of the latter. Measuring chambers under these circumstances are worse than useless, because at one time it would be found that there were two or three feet of retort near the mouthpiece with no coal, and at another that the coal was deposited right up to the mouthpiece, while the chamber was still containing a considerable quantity. The length of time required to run the charge at the Redheugh works has had to be increased by as much as 40 per cent. owing to a change of coal. Where one class of coal only is used, or where the variation in the consistency of the coal is not much, this difficulty does not present itself. It is, however, somewhat of a serious one, though it is one which should be surmounted, at any rate to a considerable extent, by the care and attention of the machineman. With machines of the De Brouwer type, there is the advantage of being able to put into the retort the heaviest charge that can be properly carbonized, without fear of difficulty in discharging, due to too little space for a rake to enter. There is also a less quantity of breeze made when pushing than when drawing.

It is probable that the repairs to the De Brouwer machines will not be excessive, and the oil and the stores used will be small. The total cost of maintenance (including oils, &c.) for West's machinery works out at 2·75d. to 3d. per ton of coal carbonized. These figures include, besides the cost of the repairs on the charging and discharging machines themselves, that also on the coal-breakers, elevators, conveyors, and air-compressors connected therewith. The cost of oils and stores alone is 0·6d. per ton of coal carbonized. With respect to this matter, it may be interesting to mention that I have known an air-motor on a charging machine to run for some 4½ years without any attention other than oiling.

Labour charges are very important in the consideration of these systems. Working two machines in place of four machines would apparently give considerable room for saving in favour of the former. The amount of this saving may be easily over-estimated, as it depends, not only on the number of machines to be manned, but also on all the auxiliary labour required in connection with the charging and discharging of retorts, such as the auguring of pipes, the opening and shutting of doors, and the stemming of fires. It is probable that in some cases it may be found necessary to employ practically the same number of men under each system, to enable this auxiliary work to be got through with such speed that the work of the machines will not be impeded.

The introduction of so much machinery into gas-works has necessitated the maintenance of a staff of fitters and mechanics, and, on larger works, of shops equipped with machine tools. The employment of a greater number of skilled and better educated men has not been without its effect on the whole *personnel* of the works. While this is so, the marked improvement in the character and moral qualities of the men in the retort-houses has, without doubt, been almost wholly due to the alteration of their work from that in which bodily strength was practically everything to that in which intelligence is most important. It has been most interesting to note the decided advance in individual men, who have worked under the two systems of hand and machine work; and so long as men continue to take thought in the discharge of their duties, so that the best results may be obtainable from the machines under their control, and the material with which they are dealing, and not develop into mere machines themselves, without thought and without consideration, so long will the advance continue with credit to themselves and advantage to their employers.

My remarks on retort-house machinery would not be complete without reference to coke-handling plant. Hot-coke conveyors are now common; they might almost be termed popular. Nothing has a more exhilarating effect on a gas manager than seeing hot coke quietly and quickly removed from the retort-house with practically no labour. Next to the charging and discharging of the retorts, the removal of the coke is the most laborious task in a gas-works; and before the introduction of stoking machinery, mechanical handling of coke after it had been drawn from the retorts had been already more or less successful. The design of a retort-house, the position of the store-yard, and the method of finally disposing of the coke, have all so much importance in the determination of the advantages or otherwise of adopting coke conveyors, that it is quite impossible to say for any size of retort-house, without definite knowledge on these three points, whether or not they could advantageously be put into use. Undoubtedly, there are gas-works where the labour required to deal with the coke is very heavy, and where a coke-conveyor will save very much more than it loses; but in a works where the labour charges are moderate, it will be well to very carefully consider if depreciation of coke, and wear-and-tear charges, will not more than balance the saving in labour. My own opinion is that it will generally pay in the long run to adopt a system in which the coke finally disposed of is of such a quality that there can be no cause for complaint of smallness, dust, or excessive moisture, even though the labour used in its manipulation may be heavier than it would be with coke conveyors. No matter what system is adopted, it must be so arranged that the coke has to fall as little

as possible. Repeated falls, even though they may be short, are most injurious to coke—rapidly increasing the percentage of breeze. Another method of increasing the quantity of breeze made is by the use of high retorts. In my opinion this is one of the most serious drawbacks to retort-settings five tiers high. In a stage-floor house, where the coke falls to the basement, there is 0·6 cwt. more breeze made per ton of coal carbonized where the average fall for the coke is 12 ft. 8 in., than in one where the fall is 1 ft. 6 in. less.

In band conveyors for carrying coal, canvas belts, on account of their cheapness, are very largely displacing rubber ones. It is quite possible, however, to lose the whole of the saving in first cost in a single year, if the surface of the canvas belt should—as is often the case—be of such an open nature that it allows the coal dust to cling to the belt, instead of being thrown off into the hopper, and finally to be shaken out on to the bottom rollers of the conveyor, causing nuisance, loss, and the expenditure of much labour in its removal.

During the last year or two, there have been patented certain purifier grids and methods of purification, which seem to have been adopted in a good many places with varying success. The fundamental object in all the systems appears to have been to increase the amount of purifying material a particular purifier can hold, without reducing the quantity of gas passing through it, and without increasing the resistance to the flow of that quantity of gas. Where oxide of iron is the material used, these systems have mostly proved successful. But up to quite recently it has been the practice of this Company to use lime solely; and with lime in fairly large purifiers, it would seem to be quite impossible with any system to increase the thickness of the layers above about 8 inches, without reducing the efficiency of the lime as a purifying agent. My experience is that the less the thickness of the layers, the greater is the work done by the lime; but a large reduction in the thickness of the lime on the grids is, as a rule, soon balanced by the increase in the labour and time required in filling and emptying the purifier. The most economical thickness to work at—depending on the facilities for carrying out the labour in each special case—varies from 8 inches as a maximum to as low as 3½ or 4 inches as a minimum.

I referred at the beginning of my address to the competition that the Gas Company of this city have had to meet from Electric Companies; and with regard to this, it might be as well to add that, notwithstanding that the Gas Company are not only maintaining their consumption, but largely increasing it, the fact remains that the Electric Companies at the same time have increased their output, and at a very rapid rate. The experience in this district has shown that there is no necessity on the part of either gas proprietors or gas managers for heartache, when they find themselves opposed by an electric supply company. At the end of some years of competition, it has been found that, though the businesses overlap, the main output of the electric companies has been absorbed for purposes for which gas had never been used. This, however, should not cause the gas companies to relax in the slightest degree the efforts they put forward to gain and maintain every scrap of business, where competition does take place, no matter how small it may be. The introduction of such a useful commodity as electricity was sure to cause some changes, and was certain to gain some adherents. These have now reached what may be termed their saturation point; and the prospects at the present time are very much more in favour of a return of those who have left gas back to it again, rather than any further alienation from it. Indeed, this is continually being found to be the case.

There has, however, recently been another competitor in the field against gas for power purposes. I refer to suction-gas plants. Much has been written on this subject; and I do not wish to go over the old ground again. But it is usual for the makers to place before possible purchasers of these plants, when they are relating the advantages that are to be gained through the adoption of them, one figure only—namely, cost per brake horse power for fuel. I had the privilege at the end of last year of making a series of tests of a 35 brake horse power engine worked by a suction-gas plant; and to the cost per brake horse power for fuel it was found had to be added the following extras, over and above that of a similar engine driven by coal gas:—

Extra interest on capital cost for gas-engine and fixing, suction plant, and extra house space	0·017d.	per B.H.P.
Extra maintenance	0·039	,, ,,
,, water	0·016	,, ,,
,, labour	0·067	,, ,,
,, oils and stores	0·015	,, ,,
Total	0·154d.	per B.H.P.

or practically a sum almost equal to the cost per brake horse power for fuel alone. In this particular case, therefore, it was necessary to double the cost per brake horse power for fuel only of an engine driven by a suction-gas plant to compare it with the cost per brake horse power for gas only of an ordinary gas-engine. These figures have been based upon the supposition that the engine would run for 53 hours per week for fifty weeks during the year.

With these additions (which will, of course, vary somewhat with the size of the engine and the district to which they are applied) to the cost per brake horse power for fuel, together with the greater liability to stoppage, the more frequent obstinacy in starting, and the much heavier responsibility on the user, it is not surprising to find that suction plants are not displacing coal gas to any great extent.

Statements are all very well, but facts are what we must deal with; and we come back once more to the present prosperous condition of the gas industry as the best reply to any question about the effect these competitions have had on the consumption of gas. This consumption for an old-established commodity is increasing at a most satisfactory rate. For what purpose is the extra gas used? The introduction of the Welsbach mantle, on account of the extra light it gives per cubic foot of gas burned, has practically reduced the quantity of gas used for lighting purposes, though it has increased very largely the number of consumers. There remain only three other purposes for which the extra gas could be used—heating, cooking, and power. Gas for ordinary heating, unfortunately, is most largely used in winter, at the same time as the maximum quantity is required for lighting. It is not therefore so easy to ascertain what assistance gas companies are receiving from the employment of gas-fires. But the use for power and cooking, and other industrial purposes, such as furnaces, should have their effect on the summer consumption; and in Newcastle we find that, while the total annual consumption increased between 1898 and 1905 by 25·31 per cent., the summer consumption increased by no less than 35·31 per cent. The effect of the use of gas-cookers is shown in still another way. If the consumption of gas on each day of the week was the same, the Sunday consumption would form 14·29 per cent. of the total. In the summer of 1898, the Sunday consumption formed 9·42 per cent. of the total weekly consumption. But in 1906, this has risen to 11·36 per cent.; and on the hottest day of this year (Sunday, Sept. 2), there was the extraordinary condition attained of a larger consumption than on the previous Saturday.

These figures indicate results that are matter for congratulation. They show that we may not only have the satisfaction of being concerned in an extensive and growing business, but that we may also have the further satisfaction of knowing that that growth is in a direction which increases the efficiency of our plant, and affords greater economy in production. Under these conditions, and with the knowledge of the result of the last few years of competition, we can indeed look forward to the future, not only without fear, but with absolute confidence that the prosperity of the gas industry will be even greater than it has been in the past.

Mr. William Ford (Stockton) proposed a vote of thanks to Mr. Hardie for his address, and in doing so said he hoped they would all take home and consider the remarks of the President. Nothing, he observed, ought to be left undone to keep in the forefront the manufacture of gas and its consumption—not only for ordinary lighting, but for power purposes and all the other auxiliaries that gas might be used in connection with.

Mr. A. C. Hovey (North Shields), in seconding the resolution, pointed out that there was not one pessimistic word in the whole of the address. The facts and the figures would be of great benefit, not only to the North of England, but to the gas industry generally.

The resolution was carried with enthusiasm; and the President briefly replied.

The Gas Institution Benevolent Fund.

The Hon. Secretary read a letter from Mr. Walter T. Dunn, the Hon. Secretary of the Benevolent Fund of the Institution of Gas Engineers, embodying a resolution that had been passed at the annual meeting of the contributors to the fund, pointing out the advisability of increasing the list of subscribers. Last year, the letter stated, the ordinary receipts fell short of the ordinary expenses to the amount of £16.

The President stated that they had had the matter before the Committee; and it was thought there were many members of the Association who did not subscribe to the Benevolent Fund at all. They had placed slips on the seats in the theatre; and members were asked to fill them in for what amount they liked.

Mr. Thomas Bower (West Hartlepool), speaking as an old member of the Committee of the Benevolent Fund, appealed for increased subscriptions, and said that many cases had come under the notice of the Committee. Had it not been for the help derived from the fund, some who had been relieved would have been in a very serious position. Every member at the meeting was able to subscribe something—if it were only half-a-guinea per annum. It would help the Committee in such a way that they would be able to extend their aid and sympathy to those who in dire distress could not help themselves.

Mr. W. Doig Gibb (Newcastle) also urged the necessity of increased subscriptions, and said that they ought to have sufficient freemasonry among the members of the profession to be able to spare a little towards subscribing to a fund which was to help the poor and needy and necessitous cases of those in the same profession, but who, perhaps, had been less fortunate than themselves. A subscription might also to some extent be regarded in the light of an insurance premium, because life and the circumstances of life were uncertain, and none of them ever knew the position that they themselves, or some of those near and dear to them, might have to take in the world. It would be a gratification if any calamity did occur to them, to know that there was a fund where the matter would be well looked after and dealt with, not publicly, but privately.

The Hon. Secretary pointed out that it was not necessary that

they should be members of the Institution of Gas Engineers in order to subscribe to, or participate in, the benefits if necessity arose. It was open to any member at the meeting to subscribe.

THANKS FOR THE USE OF THE THEATRE.

On the motion of Mr. H. WILKINSON (Harrogate), seconded by Mr. C. DRU DRURY (Sunderland), a vote of thanks was accorded the Council of the North of England Institute of Mining and Mechanical Engineers for the use of the theatre.

The meeting then concluded.

THE DINNER.

Subsequently, the members were entertained to dinner at the Royal Turk's Head Hotel, Newcastle, by the Newcastle and Gateshead Gas Company. Sir WALTER R. PLUMMER, D.C.L., one of the Directors, presided, and said he had been asked by the Chairman of the Company, Sir W. H. Stephenson, to express his great regret that he was unable to be with them that day.

The usual loyal and patriotic toasts having been given from the chair and suitably honoured,

Alderman W. SUTTON, also a Director of the Newcastle and Gateshead Gas Company, proposed the toast of the "Army, Navy, and Reserve Forces;" and in doing so mentioned that the Company had established rifle ranges at their Elswick and Redheugh works, in order that the employees might learn to shoot. He hoped other works would copy their example, so that their young men would be able to take their share in defending the country if the necessity arose.

Major W. CARMICHAEL PEEBLES responded, and said that he was gratified to know that the Newcastle and Gateshead Gas Company were encouraging rifle shooting.

The toast of the afternoon—"The North of England Gas Managers' Association"—was proposed by the CHAIRMAN. It was, he said, seven years since the Association last held their meeting in Newcastle; and at that time there were pessimists—not, possibly, in the gas profession, but outside of it—who were ready to foretell, that in the course of the next seven years, or perhaps a somewhat longer period, the business of manufacturing gas would scarcely be worth carrying on. They could, however, look back at the progress which the profession of gas manufacture had made during the intervening period; and though he did not claim to be an expert in the matter, as an outsider he hazarded the opinion that the next seven years had in store as good a time as the last had proved to be. The Association undoubtedly existed in the interests of gas managers themselves; but he was sure he was right in stating that it also existed in the interests of the gas profession, and it further existed in the interests of consumers of gas in various ways, and the public at large. Concluding, he jocularly referred to the recent balloon race from France; and said that in the course of another seven years the consumption of gas for the purpose of travelling in mid-air might be quite an important factor in the gas profession.

In responding to the toast, the PRESIDENT said that very weighty opinions had been expressed on what was known as the expert director; but he was convinced that such men as those who were at the head of the Newcastle and Gateshead Gas Company were more likely to bring prosperity to a concern than any expert director.

Mr. JOSEPH HEPWORTH proposed the "Newcastle and Gateshead Gas Company;" and said that he thought the community was very largely indebted to the Company for the effort they made in getting the restrictions with respect to the sulphur compounds removed. He hoped that the day would come when the whole of the restrictions which were still in the Acts governing certain companies would disappear.

Responding on behalf of his co-Directors and the Company generally, the CHAIRMAN said that it was true that the Company occupied a very high position among the gas industries of the country; and when he told them that in the course of the past twelve months they had carbonized over 300,000 tons of coal, he thought it would be seen they were a factor in the prosperity of the North of England.

A TRIP ON THE TYNE.

Subsequently the members enjoyed a trip down the river as far as Tynemouth; afternoon tea being served on the steamer.

Calcium Steel.—A new material suitable for the manufacture of gas and water pipes has appeard in the market, according to a recent number of the "Gaceta Minera de Espana." Calcium steel, as the material is called, is made from felspar sand and limestone. It is a compact plastic homogeneous substance of great hardness, which withstands the effects of the atmosphere and of acids. There are two methods of manufacturing articles from this composition. After mixing the two substances—viz., the felspar sand and the lime—in the required proportions in the form of impalpable powder, they can be moulded cold, compressed like bricks, and finally burnt at the temperature necessary for the combination of the constituents. The second process consists in simply melting the mixture and then filling the moulds while it is in the fused condition. Calcium steel is white; but it can be coloured to any shade by adding metallic oxides to the materials. It is thought that its properties render it an excellent material for making gas and water pipes.

THE "SELAS" LIGHT.

From Messrs. Bever and Wolf, of Bradford, comes the latest information concerning the "Selas" light—its *modus operandi* and its capabilities. As most "JOURNAL" readers know, the main characteristic of this system distinguishes it from all other high-pressure systems. It consists in thoroughly mixing one part of gas with, at the utmost, two parts of air, and in conducting this mixture, in the place of pure gas, through the service-pipes to the point of consumption, at a pressure which is regulated at will. The apparatus is exceedingly simple, can easily be fitted to any existing system of gas-piping, and is constructed for both low pressure and high pressure. The low-pressure apparatus is intended to produce lights of from 50 to 250 candle power, and works at a pressure of $3\frac{1}{2}$ to 4 inches water column, mixing two parts of air with one part of gas. The driving power is water; and a pressure of 30 lbs. per square inch is quite sufficient. The apparatus for low-pressure work consists of a compressor, with water motor, or mixer, and a mixture reservoir with a regulator; and it is made in two types for installations up to 5000-candle power, and up to 10,000-candle power. The high-pressure apparatus produces lights of from 50 to 2500 candle power. The pressure necessary is equal to 10 inches water column; and the mixture produced consists of one part of gas and one-and-a-half parts of air. The high-pressure apparatus consists of a compressor and mixer, and can be driven either by electricity or gas, steam, or transmission from any existing shafting. The driving power required is very modest, consisting of only $\frac{1}{4}$-horse power for apparatus to yield up to 10,000-candle power; and 1-horse power for apparatus equal to 60,000-candle power. The consumption of gas by the "Selas" light per candle power per hour is 0·0265 cubic foot; and it remains the same for any size of burner—that is to say, a light giving 1000-candle power consumes per hour less than 27 cubic feet of gas, which, with gas at 2s. 6d. per 1000 cubic feet, costs only about $\frac{3}{4}$d. per hour. The apparatus demands little attention, the light is beautifully steady and attractive, and, as seen, the cost is low.

THE "ETNA" INVERTED BURNER.

Its Use in Street Illumination.

It goes without saying that the greater the range of means available in developing street illumination by the incandescent burner, the better equipped is the gas industry in the competition with rival electrical methods. In articles in recent volumes of

the "JOURNAL," the possibilities of the inverted incandescent gas system for street illumination have received attention—notably in connection with the investigations of Professor Drehschmidt, of Berlin, which went to prove a superior distributive power for the inverted system, and also in connection with the trial work in

Edinburgh, which later intelligence has shown readers has eventuated in the adoption of inverted burners in the streets on a very extensive scale.

Further testimony as to the success of the inverted system in street illumination comes to us from Solihull, near Birmingham, where, throughout last winter, some 80 "Etna" inverted burners were employed in the street-lamps; and the application of these burners has been extended to 200 lamps. The lighting was started in October, 1905; and it continued until the first few days in May, when, according to the practice obtaining in the district, street lighting was discontinued for the summer months. The burner employed at Solihull is the "Etna," patented by Messrs. Arculus and Co., Broad Street, Birmingham. The lighting, we understand, quite realized expectations throughout the first winter, and gave great satisfaction to the District Surveyor (Mr. A. E. Currall). The burners are fitted in the ordinary 14-inch street-lanterns in the most simple manner. The supply-pipe is carried from the bottom up the inside at the corner of the lantern, and then the burner is hung from a stretcher across the head. The burner is surmounted by a 10-inch opal reflecting shade; and a glass bulb preserves the mantle from injury. A bye-pass is carried directly upwards from the supply-pipe. The lamps are spaced some 60 yards apart; but even so the distribution of the light was, last lighting season, reported by various observers to be very good. The lamps are fitted with single burners; but the burners can, in any suitable lantern, be increased to two, three, or four as may be desired. The greatest proof of satisfaction is that the change to the new system has been finished for the present lighting season.

This statement as to the application of the "Etna" burner in street illumination (of course, it can be used for any purpose) would be incomplete without an explanation as to the construction of the burner. The distinctive features will be gathered from the description. Starting with the nipple (which contains three holes), the burner is generally fitted with what is called the No. 4 size; but the nipples are interchangeable, so that larger or smaller ones may be used if desired, according to the ruling quality or pressure of the gas. With the No. 4 size, under the conditions most generally met with, the gas consumption is approximately 3 cubic feet; and one test that has been made accords to the burner an illuminating power of 62 candles, with a consumption of 2·8 cubic feet of gas. At the top of the bunsen is a shutter to regulate the primary air supply. The construction of the bunsen tube is such that it fulfils a double duty. It gives to the gas and air the utmost opportunity for thorough admixture, and it is also designed to prevent lighting-back, which is an important consideration in burners for use in street-lanterns or draughty places. The bunsen tube is constructed of various parts; and the portion of the tube between the upper part and the nozzle is made double—thus forming an annular space, serving as an inner chamber for heating the gas. This construction, however, is more particularly designed to prevent lighting-back. The inner bunsen tube extends downwards, and is closed at the end. In its sides, however, are gauze-covered apertures, through which the mixture passes into the annular chamber formed by the outer tube at the lower part. This outer tube diminishes in diameter as it approaches the nozzle, which is easily replaced. Just above it is the mantle-holder, which is adjustable. The construction of the burner is such that any part from the gas-nipple to the nozzle is replaceable without renewing the whole burner.

In the design of the burner, there has been a great belief in the virtue of heating the mixture of gas and air; and it is on account of the special devising for this purpose that the word "regenerative" has place in the description of the burner. There is a hood or casing round the top part, which, while the burner is in use, maintains a hot-air jacket round the upper portion of the bunsen; and around the lower part there is an opal glass converger, forming an outer heating chamber. The burners the Company first made were solidly constructed; and this caused them to be somewhat heavy, and, in fact, there was a waste of metal. Now that is altered; and the firm are making a good burner which has a commercial value more in accordance with requirements.

For large space and exterior lighting, the firm are making lamps fitted with two, three, or four burners as required. We have had an opportunity of examining these, and can attest the excellence of their lighting and distributive power. In their case, the gas consumption and illuminating power can be approximately found by multiplying the figures already given for the single burner by the number of burners in use. These lamps have a good appearance; and the glassware supplied for them is of the best and choicest descriptions.

LOWERING A LARGE WATER-MAIN.

[From "Engineering Record," New York.]

At the intersection of Crotona Avenue and Southern Boulevard, Borough of Bronx, New York City, one of the 36-inch city water-mains, under a service pressure of about 40 lbs., had been left partly exposed above the surface of the ground by the grading recently done on Southern Boulevard. The profile of the pipe was a long vertical curve with a versed sine of about 2 feet between the extremities of the 500-feet section. It was decided to lower the pipe to its permanent position on a uniform grade about 5 feet in maximum depth below the original position of the pipe; and as not only the domestic water supply, but also a number of large factories in the neighbouring district were dependent on this main, it was essential that it should not be long out of service.

Several plans for lowering it were considered—among them the advisability of connecting the main, beyond the ends of this section, with a parallel pipe at the required grade by means of curved specials—thus diverting the flow through the new line, and enabling the corresponding section of the original main to be removed. It was foreseen that the time required for connecting the old and new portion of the pipe would necessitate interruption of the water supply; and this, together with the large amount of excavation needed for the bye-pass, which was chiefly in rock, caused the rejection of this plan.

The plan finally pursued consisted of a very simple and efficient method of lowering the pipe vertically in place without disturbing the original connections, and with only a very short period in which the water was cut off from the lower district. Trenches about 3 feet wide were opened on both sides of the pipe, having a combined width of about 9 feet from out to out. These were carried down to the surface of the rock; and all the material originally back-filled over the pipe was removed, exposing the sides and bottom of the original trench. Survey was then made, the elevation recorded for purposes of estimate, and the 3 feet trenches were extended on both sides of the main to the required grade at a maximum depth of 7 feet below the original surface. The rock underneath the pipe was then removed by working in from these trenches—leaving pillars supporting the main at the hubs 12 feet apart, on which each length of pipe was supported by its original wooden bed-blocks. Each length was supported at its middle point by horizontal transverse wooden blocking, built up solid from the bottom of the trench. The rock pillars and bed-blocks were then removed, and the bed of the trench dressed to grade, and recessed to clear the hubs.

The whole pipe having thus been exposed and supported, operations were commenced at one end by a gang of about 25 men with four 10-ton jack-screws and three wheel-tripod derricks fitted with hand windlasses. The jack-screws were set underneath consecutive lengths of pipe on the centre line, as near as possible to the wooden cribbing, and were operated until they released the latter. The upper blocks were then removed, and the pipe was lowered a maximum amount of about 2 inches at the centre of the five-length portion under treatment. The jacks were then operated very carefully, so that this amount should be distributed between all the six joints affected—thus reducing the movement in each joint to a uniform amount of $\frac{1}{8}$ inch, and flattening the curve originally made by the axis of the pipe. When this operation was completed, the jacks were moved forward to support the succeeding five lengths of pipe; and the operations were extended over the whole 500 feet exposed.

When the main had thus been reduced from a circular curve to a uniform grade, the operations were continued by placing the jacks at one end of the main and lowering it bodily, as before, in six-length portions successively from one end to the other and returning—effecting a depression of from 2 to 3 inches at each trip. By repetitions of this process, the pipe was finally lowered to its required position at the new grade. When the distance between the pipe and the bottom of the trench became so small that there was no clearance for the jacks, their use was discontinued, and the remainder of the lowering was effected by the wheel derricks.

Trenching was commenced on July 18, and was completed and the pipe supported on the timber cribs ready for depression on Aug. 25. In order to avoid interference with the manufacturing establishments, the lowering of the pipe was postponed until Sunday, Aug. 26, when the water was shut off at 6 o'clock in the morning, and the jacking commenced. It was completed, and the pipe was under process of filling at 5 o'clock in the evening of the same day. A sleeve existed in this section of the main, allowing sufficient play to provide for the excess length of pipe developed by the change from the curved to the straight line, and thus enabled the new alignment to be in a straight line without lateral displacement. The work was done under the direction of the Department of Water Supply of New York, Mr. I. M. de Varona, Chief Engineer, Mr. C. H. Steers, Assistant-Engineer in charge.

Use of Tar to Prevent Dust.

In the course of the proceedings at a meeting of the Association of Municipal and County Engineers held at Windsor on the 29th ult., Mr. Brown advocated the use of oil-tar on the roads as an efficient preventive of dust. He said it was a cheap material, costing only ¼d. per square yard for each dressing; while four dressings a year were sufficient. He contended that it would be cheaper to use such a material than to go to an excessive cost with watering. Mr. W. Calder, the City Engineer of Praham, Victoria, said he was quite in accord with a previous speaker in saying that Westrumite and other preparations of crude oils—at least, in his experience in Melbourne—had proved a failure. Their beneficial effect was only temporary. The dust evil was a very patent one in Melbourne—it was even more so than in this country, where, if he might judge by the past summer, they had scarcely any wind. In Australia they had high winds and long droughts, and dust was a great trouble. The most efficient preparation they had used was distilled tar—not the oil from distilled tar on the lines of Westrumite. This distilled tar would last for a year, and made a clean surface in winter.

MIDLAND JUNIOR GAS ASSOCIATION.

The first Meeting of the second session of the Midland Junior Gas Engineering Association was held on Saturday, at the City of Birmingham Technical School; the business consisting of an address by the incoming President (Mr. G. W. G. Tatam) and the reading by Mr. W. Angus of a paper on "Coal and Coke Handling Plants."

The Hon. Secretary (Mr. James Hewett) read the minutes of the previous meeting, and several letters of apology for absence. He also announced the receipt of contributions towards the funds of the Association from Mr. G. Hampton Barber, Mr. Thomas Berridge, and Mr. W. Chaney.

Mr. F. J. Bywater (the Retiring President) remarked that his duties that day were of the very lightest. He had only to introduce to the members Mr. Tatam, the new President, and to ask them to accord to him during his year of office all the kindness they had shown to himself. He might perhaps call attention to the fact that the Council had arranged to have the papers printed in advance and copies circulated among the members. This, he thought, would prove of the great possible assistance in promoting good discussions.

The President then delivered the following

INAUGURAL ADDRESS.

Gentlemen,—I would take this opportunity of thanking you for the honour you have done me in electing me your President for the coming year. The past year—the first of our existence—has been one upon which we have every reason to congratulate ourselves, not solely from self-satisfaction, but after consideration of what we have really done, and the resultant effect of our endeavours on people outside our Association. I trust that this year, under my presidency, the Association will continue to flourish, and firmly establish itself *nulli secundus* of the Junior Associations. I can assure you of my utmost endeavours to further its interests; and, from my knowledge of the Council and the members, I have no fear of other than your steadfast loyalty and heartiest co-operation in the work. I am deeply conscious of the honour you have done me, and trust that at the termination of my year of office neither you nor I will have any but the brightest view of past, present, and future.

My address this year will be somewhat different from the usual line taken by Gas Associations, and will, I trust, be acceptable. I wish to show, as far as I am able, the benefits which have accrued, and must accrue, from a knowledge of chemistry and physics properly applied to our own and the other branches of the engineering profession.

There has sprung up during the past few years a relatively great demand for scientific help in the various industries; but in many cases the innovation has not met with the success anticipated. Why is this? Mainly for three reasons.

(1) A proper appreciation of the Sciences has not been extended to those engaged. It has been looked on as something magical, where one turns the handle and results and profits are evolved without expenditure either of money or time.

(2) The appointment of unsuitable men. Of the badly trained man, little need be said. But of the highly trained men, specialists in one branch, who are without even a superficial knowledge of the practical and other sides of the particular industry, these men are at home and useful in a laboratory, but are generally found wanting when they have to extend their actions to a works' problem comprising large and various plants. I do not wish to infer that such men could never solve a problem, but rather that so much has the laboratory and its finer methods become part of their nature, that such essentials as cost, expediency, practicability, &c., are lost sight of. In course of time, these faults are eradicated; but in these days of keen competition, time is money, and such faults mean sometimes great losses.

(3) Limiting the scope of the chemist is another fault which in the past has checked, and to a great extent still stays, the advance. The chemist should be regarded as the Intelligence Department, and should be given a free hand and as much assistance, within limits, as he requires. He should be subordinate only to the chief of the department, in order that he should be entirely free, and that his successes should meet with their just reward, instead of being a go-between to be kicked by all and sundry, as is more often the case.

The first department of engineering with which we of the gas industry come into contact is the constructional branch; and I do not regard this as purely civil engineering, but a combination of civil and mechanical. The chemical influence on this branch is not apparent until we bring ourselves to the consideration of the materials of construction—viz., iron, steel, cement, &c. It is then that the chemical influence shows itself. When one has the opportunity of comparing side by side an old structure, with its huge cast-iron columns and girders, with one of the modern buildings, composed of light steel work, and looking to the unitiated as if the first strong wind would bring it to the ground, the question which arises is, To whom must we credit this wonderful change? I do not propose to argue the question except to say that the progress of knowledge in the chemistry of iron and steel has been the leading factor of this advance.

Again, reviewing the numerous changes which have been brought about in the steam-engine and plant, and which can be directly traced to the reduction in size and higher speeds brought about by the reliance that can now be placed on materials used in construction, and the adaptability of various metals and alloys for special uses, I might instance the use of the various complex steels—viz., Mn, Wo, Ti, Va, Co, Ni, or Manganese, Tungsten, Titanium, Cobalt, and Nickel steels—in machine-tool making, and by means of which the hardest materials can be machined in the shortest space of time. I think when I have reviewed the advance of the iron and steel industry, you will be in agreement with me that the application of the Sciences to this industry, formerly dependent on "rule-of-thumb practices," has been for its betterment. I would not have you suppose that the last words have been said on the subject of the chemistry of iron and steel, because even now new ground is constantly being opened up, and new processes evolved. The year 1855 may be regarded as the beginning of the advance. Prior to this—the year in which the first Bessemer converter was used on a commercial scale—no other method than the cementation process was known for the production of steel. This process—a long and unsatisfactory one—demanded the reduction of the ores in the blast-furnace, the making of pigs, puddling, pressing and rolling, heating the pressed wrought iron in the presence of carbonaceous material for days at a red heat, and at the end of all this the steel was of a heterogeneous nature, and required grading and remelting. The Bessemer process reduced all this to the operations of running the metal from the blast-furnace into the converter, there "blowing it" for a few minutes to remove all its impurities but phosphorus and sulphur, and bringing this "blown" charge to the required state or carburization by adding highly carbonaceous alloys such as speigeleisen or ferro-manganese. The evolution of this process at once brought cheap steel on to the market; but the disadvantage of phosphorus remaining in Bessemer steel rendered it useless for some purposes, and only non-phosphatic ores could be used. Gilchrist, a chemist, in conjunction with his cousin Thomas, sought to overcome this difficulty, and eventually did so by introducing the Gilchrist-Thomas basic process.

Had it not been for the complete investigation by the chemist Gilchrist, who went into the thermal considerations as well as the strictly chemical ones, progress might have been delayed for still another twenty years, as Bessemer quite failed to appreciate the fact that the high temperature of his conversion rendered the carbon active enough to accept all the oxygen at the expense of the phosphorus, which remained as phosphides; and it was only during the "overblow" that these could be partially eliminated in his acid-lined converter. He also failed to recognize (or did not try to) that a basic lining or flux would aid in the elimination of phosphorus by the formation of phosphates at a comparatively low temperature.

The next advance was along the line of fuel economy by Siemens Bros., who first introduced the reversible regenerative furnace fired with producer gas, in which both the gas and air were preheated by the waste gases from the furnace. Such preheating admitted of exceedingly high temperatures being obtained at so low an expenditure, that these furnaces were adapted to the iron and steel industry. The original Siemens process was unique in the fact that it combined to an extent the duties of the blast furnace and converter—*i.e.*, the reduction of the ore to the metal and the decarbonization of the pig. The ore being essentially an oxide, was reduced by the carbon contained in the pig, and only so much ore was put in as was required to completely "boil off" the carbon, leaving a pure metal which could be recarbonized or alloyed to a prearranged degree and to a nicety, seeing that the atmosphere of the furnace could be made at will either reducing or oxidizing. This feature—*i.e.*, the ready adaptability of the atmosphere of the furnace—was afterwards made use of in the Siemens-Martin process, where pig and steel scrap were used; the steel scrap (having the highest melting-point) being made the oxygen carrier, in place of the ore.

It must be readily seen that, from the time of Bessemer's first converter, the changes have been in the direction of cheapening and rendering the processes adaptable to all demands; and as a consequence we can now obtain mixtures suitable for all purposes. It is indisputable that these advances are necessarily the result of the combination of chemist and engineer—the latter demanding, and the former devising, processes to meet these demands. I shall not treat further with this industry, except to mention that it is one that has made most rapid strides, and has universally recognized the value of scientific investigation.

I would now say a few words as to materials, such as lime and cements. So well is the composition of ordinary building lime and the chemical mechanism of hardening known to you, that it would be superfluous to here detail it; but I would draw your attention to a few facts of especial interest concerning cements. Cements, perhaps, are more complicated, and their properties less understood by those who use them than is allowable in these days of huge structures both above and below earth and water; and practically the only tests that are to-day made on cements are such as can only rightly be called mechanical—viz., fineness, specific gravity, setting point, expansion, and tensile strength. Chemical examination does not enter into the question. Now, it is not infrequently found that, notwithstanding the selection of the best possible foundation—in fact, almost perfect—structures in which cements satisfying the above tests are employed have, after some long lapse of time,

developed cracks and become porous; and on examination this is found to be due to circumstances other than settlement, and dependent on the composition of the cement used.

I think I may here treat briefly of the general composition of portland cement. It is produced by the heating to "clinkering point" of definite mixtures of limestone and chalk, with clay substances and silicious earths, and grinding the resultant clinker to fine powder. Now the fusion is carried out with the object of forming two essential compounds (which each has a separate function)—viz., tricalcium silicate, tricalcium aluminate. The hardening process differs entirely from that of lime, and depends on the hydration and the interaction of these two compounds. The aluminate reacts in the following manner:—

$$3\ CaO\ Al_2O_3 + Ca(OH)_2 + 11\ H_2O = 4\ CaO\ Al_2O_3\ 12\ H_2O.$$

The silicate reacts as follows:—

$$2\ (3CaOSiO_2) + 9\ H_2O = 2\ (CaOSiO_2)\ 5\ H_2O + 4\ Ca\ (OH)_2$$

It will be seen that the lime set free in the second reaction is essential for the first or "setting" reaction. The actual mechanism is one of solution and crystallization, and need not here be extended beyond mention. There are several substances occurring in the raw material which, although taking no part in the fusion reaction, affect the cement on mixing. The chief of these are $CaCO_3$ and MgO. It has been found (as stated above) that frequently cements which pass satisfactorily the mechanical tests fail in actual practice after a long time; and it has been found to be due to the presence of the above, which cause cracking and disintegration due to change of physical state. There are other substances which cause failure, and can be briefly referred to. Excess of alumina over 10 per cent. in cements, though it tends to quick setting, renders it unsuitable for use in moist air or sea water. This is due to the fact that it forms soluble compounds which dissolve out and leave the structure porous. In presence of SO_4 this is most marked; and even the calcium compounds will be disintegrated, due to solution of $CaSO_4$. A cement containing more than 2½ per cent. of sulphate calculated as H_2SO_4 should not be used except for the roughest class of work, or, better still, not at all. The presence of sulphates also lengthens the time of setting. Magnesium oxide above 5 per cent. causes cracking and disintegration, and is most dangerous, as the trouble is slow in development, and is only noticeable after the damage has gone too far for speedy and easy repair.

It is apparent from the above remarks that chemical investigation in this important industry is most necessary—not only among the manufacturers, but also among the users. "*Humanum est errare*" is applicable to manufacturers as well as to erectors. Much work has been done in this direction by that most eminent chemist Le Chatelier, who fixed a ratio for the acid and basic constituents of cements, which he termed the Hydraulic Index (the ratios are between the chemical equivalents)—

$$\frac{CaO + MgO}{SiO + Al_2O_3} \begin{matrix} < \\ = \end{matrix} 3 \qquad \frac{CaO + MgO}{SiO_2 - (Al_2O_3 + Fe_2O_3)} \begin{matrix} > \\ = \end{matrix} 3$$

And the fact that the French Government specify for chemical investigation gives weight to his researches in this vast industry.

A most important phase of the constructional question is that of the preservation of stones and masonry. The atmosphere of manufacturing towns is, as you are aware, of an acid nature; the particular acid varying with the particular industries of the district. This acid, carried in the air which also contains moisture, has a deleterious effect on masonry in general. Some resist the action better than others; but all are wholly or in part affected, and many structures have been rendered unsafe—due to this corrosion. A process recently developed by Professor Church can be applied either as a preservative or as a renovator. It depends upon the precipitation within the pores of stone of insoluble barium sulphate. The stone, even when it is in a too far advanced state of crumbling to be brushed, can be made sound. Baryta water is applied by spraying, and allowed to penetrate the stone a sufficient number of times to form a more or less solid material. If the corrosion is due to the action of sulphurous fumes, the interaction between the sulphates in the stone and the baryta will be sufficient to give a filling which will be equal in hardness to the original stone, and be non-corrosive. If the corrosion is due to either chlorine fumes or hydrochloric acid, the treated stone must be sprayed with a soluble sulphate—*e.g.*, a solution of aluminium sulphate, which converts the baryta into the insoluble and acid resisting sulphate. So acute is the action of moisture deposited from the air of towns on stonework, that it is considered necessary to protect even treated stone with a solution of paraffin wax, which, after a lapse of a few hours, is driven in by heat. This treatment has been extended to the preservation of ornamental marble work, and found successful. On the utilization of slags, clinker, &c., in the manufacture of artificial stones, I do not wish to dilate, except to mention that admixture of suitable quantities of lime with the slags, and the action of superheated steam, after subjecting to hydraulic pressure, has given us a cheap material which has up to the present shown remarkable durability in all circumstances.

Of the department of mechanical engineering, I have already dealt with the purely mechanical portion—*i.e.*, materials of construction—and would now deal with such questions as fuel economy, water softening, and various other details. In my paper to you last year, I dealt fully with the mechanism of combustion, so shall not introduce that portion of the subject again. What I would bring before you is the extravagant use of fuel under boilers, and the methods of overcoming this waste which have been recently introduced. Fuels are of various types and grades—solid, liquid, bituminous, non-bituminous, large to dust; and each kind requires different methods of combustion. The principle—*i.e.*, the combustion with the oxygen of the air—is the same for each type. From observation of present-day boiler practice, boiler men in general seem unconcerned with the quantity of fuel burned, so long as their boiler pressures are kept up.

For a given weight of fuel to be consumed, it is necessary to bring in contact with that fuel a definite quantity of air, and to bring it into contact in a certain way, so that each particle of fuel is surrounded with a constant supply of fresh air. Provided that the coal is of fair size and non-caking, this is not difficult, because the interstices between the lumps allow free passage through the coal for the air coming through the grate-bars. If, however, the coal is small or of the coking variety, then there is difficulty in getting the air through the mass. The necessity for doing so much of the combustion by means of the grate-bar supply is that a limited quantity of air through the bars causes development of carbonic oxide; and this being drawn over the surface of the mass of coal is frequently found in the waste gases—proving that the clinkering-door supply is more or less inefficient. To get over this difficulty of grate-bar supplies, forced draught has been found efficient when introduced under the grate. Not only does it increase efficiency, but also the capacity of the boiler. Top draughts introduced through the furnace-doors are inefficient for one reason, as already stated, and also because they cool the gases above the fuel—due to their preponderance over that required for actual burning. With bituminous fuels and slack, it is found most difficult to prevent loss of fuel due to the sudden rush of gas and small fuel after firing, and to the temperature of the combustion chamber and air being below that of the ignition-point of the mixture. A method was introduced for gradually feeding this type of fuel mechanically on to a plate in front of the fire-bars, then coking it, and afterwards pushing it forward on to the bars. It was found even then to be not entirely successful; and various devices for delivering warmed secondary air supplies over the fuel were tried.

These devices were in part successful; but a better appreciation of combustion and its peculiarities led to a very neat and effective arrangement for feeding boilers. The more intimate the mixture of fuel and air, the easier and more complete is the combustion. Therefore gaseous mixtures are perfect for this purpose. Liquid fuels due to the ease of "atomizing" with air or steam injectors are also most efficient. We cannot liquefy or easily gasify our solid fuels, but we can render them so small that they become similar as to the ease with which they can be carried and suspended in air currents. The process mentioned above, in which all coal is crushed to powder and whipped into the furnace, consisting of the flue-tube (lined for the first length with fire-brick, so intense is the heating effect) without fire-bars, by means of steel brushes working on a plate upon which coal dust is fed from a hopper, is therefore based on scientific principles, and is practically as well as theoretically most efficient. A proper appreciation of the above facts will enable us to get the best from our coals, whatever fuel is used.

Economy in fuel, and indeed in general working, is much augmented by the use of only the most suitable waters in our boilers. It is usually thought sufficient to add solutions of soda caustic to boilers and feed-water, on the grounds that they precipitate the impurities as a mud, which can be "blown off" each day instead of gradually crystallizing out from the solution as the water becomes saturated. The mud is, of course, the scale-forming impurities thrown down by the caustic soda. The deposition of this mud in the boiler does not, however, stop the scale formation entirely, and in some cases only to a very slight extent. The deposition of mud in the boiler is therefore not to be recommended for the above reasons; and also, should there be a relatively large quantity of chlorides in the water, they, in conjunction with the mud, will cause priming. The better—in fact, the best—method is the treatment of feed-water before it enters the boilers. You have then a water almost entirely free from suspended or soluble matter. Most water-softening processes depend upon the reaction of lime and soda in depositing the calcium and magnesium salts. The chalk present in the water is held in solution by the excess of carbon dioxide contained in the water; and when this excess is driven off, either by heat or by neutralization, the chalk is deposited. Magnesium salts—such as sulphate, carbonate, and chloride—exist in the waters; the latter being a strong corrosive, and causing pitting of the plates.

The practice was formerly to add cream of lime and a solution of soda-ash in quantities sufficient to precipitate the impurities, and then to allow the mixture to stand until the precipitates settled. It was claimed that this treatment removed the calcium and magnesium salts. Of the calcium, this is true; but the magnesium which forms a very hard scale remained in, and did not come down until subjected to a temperature above 80° C. So that in the most modern arrangements for softening water, this magnesium deposition is carried out by preheating the feed water, and giving it a tortuous and slow travel through a sludge separator. The effect of this economy in fuel and softening of water has saved on one boiler I have in mind £38 in one year; so nothing further as to economy need be said. With regard to steam-engines and internal combustion engines, much advance has been made. A more thorough appreciation of the physics

of superheated steam and the evolution of soft metallic packings has allowed us to reduce the size, and at the same time increase the power, of our modern plant. A chemical study of our lubricants and their power to carbonize under the various conditions existent in cylinders, has also had great influence on high speeds. The gas-producers, suction and otherwise, which we have heard so much of recently, are yet another step towards the scientific realization of perfect energy-return from our fuels.

With regard to our own industry, which embodies more or less all the features mentioned above, but which in its main feature—*i.e.*, carbonization of coal—has made no startling changes, we are still content to put coal into a retort and destructively distil it without the slightest knowledge of the results of the distillation, except that the gas will probably be somewhere between 14 and 17 candles illuminating power. Other facts, such as composition, are entirely overlooked. Even the introduction of the vertical retort has in no way helped us in this direction. The greatest improvements have been in the working up of residuals—tar, liquors, and cyanogen compounds—and in such adjuncts to supply as water-gas systems. Various solvent processes for the extraction of naphthalene have been brought forward of recent years; and though in some cases the plant and solvents are more expensive than is desirable, the methods have been very beneficial in keeping down complaints by removing one of the greatest enemies of perfect distribution. You are all quite familiar with the work of the famous Chemist Welsbach, who some years ago gave our industry a fresh lease of life by the introduction of incandescent mantles. He at the time was working on the subject of electric lamp filaments, as so many chemists have done and are doing. The introduction of such lamps as the Nernst, Osmium, Tungsten, and Tantalum filament lamps and flame arcs is directly due to the work of the chemist, as is such apparatus as accumulators of both the wet and dry type. Our competitor in lighting has seen the advantage of scientific thought, and has fostered it; while, except for some few instances, the gas industry has given little encouragement to the scientist, and is the worse for it.

I think I have now brought before you facts which will clearly demonstrate what has been and can be done, in the interest of any industry, by a thorough and proper appreciation of the Sciences; and I trust that, though differing somewhat from the generality of addresses, mine has been interesting, and will direct your thoughts towards the advancement of our industry.

At the conclusion of the address,

Mr. S. T. Smith (Walsall) said he had great pleasure in proposing that their heartiest thanks be given to the President. He had followed the address with very much interest; and he thought that they would all derive substantial benefit from a careful consideration of the points that had been brought forward. First, there was the progress that had been made in the iron and steel industry; and then cement was dealt with in a manner that had been not only interesting but instructive. There was one point with regard to the latter subject to which he rather wished the President had called attention—that was the fact that spent lime was now getting more used for cement making. He knew one or two works where it was so employed; and it was said that the cement was quite as good. The possibility of getting rid of their refuse in this way was an important consideration for gas undertakings. Then he had also dealt with the questions of combustion and boiler incrustation. Altogether it appeared that chemical knowledge in gas-works was not very far advanced; it was more mechanical engineering. He thought, therefore, that great credit would be due to the President if he had succeeded in inducing them to seriously consider the various points in a gas-works where chemical knowledge might assist them in the daily routine of gas making and the working up of residuals.

Mr. J. H. Willoughby (Leamington), in seconding the motion, remarked that the President had brought before them a very interesting subject; and if the address was somewhat "off the beaten track," it was none the less valuable to them on that account. So far as he himself was concerned, he might say that he had received some instruction from what the President had told them.

The vote having been enthusiastically carried,

The President, in acknowledgment, said that though, as had been remarked, his address was somewhat "off the beaten track," he thought the matters dealt with would be of interest to the Association. He had, perhaps, said little or nothing about the gas making industry; but they all of them now read the Technical Journals, and so were able to keep themselves well in touch with what was going on. It just occurred to him, however, that it would be useful if he drew attention to the good results that had been attained in connection with industries which fostered the chemical side more than the gas industry had done. In many cases, the Sciences were "pooh-poohed" on gas-works; but, of course, this must come to an end some day, and the sooner the better. What he had said with regard to the benefits derived by other industries, might tend to show the members of the Association what might be done with their own industry if they applied the Sciences to it in a proper manner. No matter what position a man occupied on a gas-works, he would find that a knowledge of the Sciences—however small it might be—was of tremendous assistance to him. It would enable him to thoroughly understand processes, and so regard them in a proper light. Take carbonization, for instance, a stoker did not really understand why he should put his charge in level, and the effects of unequal heating or things of that sort. All he knew was that he put the coal in and got gas and coke out. As long as an industry continued on these lines, it could not be completely successful. Great advances had been made in respect to the power required for electric lamps. In the case of the Tantalum lamp, this had been reduced to under one-third of what was needed for the best of the carbon lamps. He believed that the actual quantity of current for the average incandescent lamp was 3·5 watts per candle; whereas with the Tantalum the latest results were 0·75 watt per candle. It was purely experimentation by chemists that had brought this lamp to perfection; and, in fact, so good was the light nowadays that even the electric light companies themselves were beginning to shiver in their shoes, because they did not know what to do with the large amount of plant that they had put down in estimating for their probable consumption. Of course, electric light undertakings were not like gas-works—they could not store.

Mr. Angus's Paper.

Mr. W. Angus (Nechells) then read his paper, on "Coal and Coke Handling Plants;" but unfortunately pressure on our space compels us to hold over this (together with the report of the interesting discussion to which it gave rise) until next Tuesday's issue.

Programme for the Session.

The dates of the subsequent meetings of the present session, and the programme arranged for them are as follows: Nov. 3, a visit to the Coventry Gas-Works. Dec. 1, a paper by Mr. A. O. Jones, of West Bromwich, on "Benzolized Water Gas." Jan. 5, a paper by Mr. R. J. Rogers, of Birmingham, on "Distribution and Gas Supply." Feb. 2, a paper by Mr. A. N. Comely, of Windsor Street, on "Refractory Materials used in Retort-Settings." March 2, annual general meeting; election of officers for 1907-8, &c.; and a paper by Mr. W. Wastell, of Birmingham, on "Gas-Works Statistics." April 6, a visit to the Leamington Gas-Works.

SCOTTISH JUNIOR GAS ASSOCIATION.

Eastern District.

The Scottish Junior Gas Association—Eastern District—opened their session by the holding of the Third Annual General Meeting on Saturday afternoon, in the Heriot-Watt College, Edinburgh. There was a gratifying attendance of members, over which Mr. James Dickson, of Kelty (late of Dunfermline), presided.

The President opened the proceedings by expressing his pleasure at seeing so large an attendance at the commencement of their work for the session. It was to be hoped that it would be as successful as its predecessor. He thought he was right in saying that there was now more solidity in their ranks, and that, as time went on, their opportunities for good work would increase, and their means of obtaining knowledge would widen and extend in many directions yet unheard of. The kindly—he might almost say the jealous—interest which the members of the Senior Associations took in their proceedings was proof that the establishment of Junior Gas Associations was doing much to produce a better class of artisans, who would in turn, qualify for a better class of gas manager. Promotion would only come to those who took a healthy and enthusiastic interest in their work; and, to the real student, no better way of spending a Saturday afternoon could be imagined than in visiting a large gas, engineering, or chemical works. The advantages were manifold, and perhaps outweighed those that were obtained from the reading and discussion of a paper, however excellent the latter might be, as a means of education. They, as a Junior Association, ought to feel proud that the North British Association opened their ranks, both at the Informal and the General Meeting this year, to the Members of Council of the Junior Associations; and he should like to express the wish that they might see the senior members of the profession taking advantage of the welcome they were always willing and ready to extend to them at their meetings and excursions. The syllabus for the session which they were entering upon was a most excellent one, and reflected great credit upon Mr. Rule, their Hon. Secretary, who had been most zealous in all his endeavours to make their work a success. Unfortunately, as they knew, they were to lose his services; and he (the President) thought he could not do better than tell him now that, along with Mr. Masterton, he had formed the bed-rock of their Association. They were now firmly established, thanks to these two gentlemen; and the official coming after Mr. Rule would, he knew, find that everything was down to date.

Report of the Council.

The Council, in their annual report, stated that at the end of last session there were 8 honorary and 82 ordinary members on the roll of the Association. The Council desired to thank the senior members of the gas profession who had taken so great an interest in their proceedings. They also expressed their thanks to Principal Laurie for the use of the Heriot-Watt College in

which to hold their meetings, as well as those companies and corporations whose works they had the privilege of inspecting during last session—valuable knowledge having been gained by the members through these visits. The attendances at the meetings and visits were fairly good. The Council had pleasure in noting that during the session several of their members had been appointed managers of gas-works—viz., Mr. John Ireland to be Joint Manager of the Tayport Gas-Works, Mr. James D. Keillior to be Manager of the Lochgelly Gas-Works, and Mr. James Dickson and Mr. H. Matterface to be Managers at Kelty and Bilston.

The report was adopted.

PRESENTATION OF THE ASSOCIATION MEDAL.

The PRESIDENT then presented Mr. W. Mitchell, of Dundee, with the gold medal of the Association, for the best paper read during last session. Mr. Mitchell's paper on "Retort Setting in Relation to Carbonizing" was, he said, a practical one for practical men, and most of them would have found in it some very useful information.

Mr. MITCHELL briefly returned thanks for the honour which, he said, had come upon him as a surprise.

ELECTION OF OFFICE BEARERS.

The HON. SECRETARY (Mr. H. Rule, of Falkirk) intimated that, in accordance with the rules of the Association, Mr. William Brown, of Lasswade, the Vice-President, became President, and that, as the result of the ballot, the other offices had been filled as follows:—

Vice-President.—Mr. D. Bisset, of Edinburgh.

Hon. Secretary and Treasurer.—Mr. John R. Moyes, of Edinburgh.

Members of Council.—Messrs. J. Dickson, of Kelty; H. H. Gracie, of Edinburgh; J. Simpson, of Inverkeithing; W. Williamson, of Leven; G. Alexander, of Edinburgh; and J. Davie, of Edinburgh.

Auditors.—Messrs. J. G. Farquhar and J. Davie, of Edinburgh.

The PRESIDENT returned thanks for the help he had at all times had from the members, and introduced his successor—Mr. Brown—who took the chair.

PRESENTATION OF THE PRESIDENT'S MEDAL.

Mr. Brown's first duty was to present the President's medal to Mr. Dickson, which was done and acknowledged in a few words.

PRESIDENT'S INAUGURAL ADDRESS.

The PRESIDENT then delivered his Inaugural Address, in the course of which he said:

Following as I do, such men as your two Past-Presidents, it is no light task that has been imposed upon me; but, with your help and sympathy, I shall attempt to maintain the high standard of excellence which has always characterized the work of this Association, and direct all my efforts for the further well-being of the members. It is a matter for congratulation that the Association remains in such a flourishing condition. The membership during the past session was 82 ordinary and 8 honorary; and it is with much pleasure that we include this year in the latter Mr. James Kincaid, of Kirkcaldy, and Mr. J. W. Napier, of Alloa. May such a state be but a spur to us to attain to even greater achievements. Let each member realize his individual responsibility as part of the whole, and endeavour to discharge that responsibility by contributing what he can, however little, to the records of our Association—helping thereby to keep it in the forefront as a potent and ever-present factor in the history of the gas-making industry. We may not individually be able to do much; but let us not be afraid to reveal what we may have gained by our experience, in imparting to each other what we have learned, not only by our successes but also by our failures, for by so doing we may learn much which, though seemingly trivial, may likely be of service to us in the future.

In these days of keen competition, an individual cannot get on alone; we must look to others for information. For myself, I may say that when in the vicinity of a gas-works, I never lose an opportunity of calling and observing how things are being done there, the nature of the appliances used, and the method of working them. It is wonderful how much knowledge we can gather in this way regarding the manufacture and sale of gas under conditions different from our own. Let me say, too, in passing, that we should never be above taking information from our subordinates, for we can often get valuable hints from them.

Having attained a standard of proficiency in our own line, it will not do to rest on our oars. We must be up and doing battle with our keen competitors, electricity and suction gas, and increasing our knowledge, not only of gas, but of those different forms of lighting and power. Happily, in my own district, we have not yet been opposed by any lighting scheme, nor have we up to now had any suction-gas plants fitted in the district. For this I think the arrangement of the reduction of price where gas is used only for power is responsible. I think it must be a matter for congratulation to those who are opposed by electric light that the authorities are now beginning to appreciate the value and economy of the incandescent burner for public lighting purposes, and in many cases superseding electric lamps by this new type of burner.

The opportunity of attaining proficiency lies at our very doors, to be obtained at a merely nominal cost. Take this Heriot-Watt College for instance. One can learn almost anything here, and one has moreover no excuse in the way of travelling expenses, for the local authorities will generally provide funds for the payment of train fares of students attending these classes. I myself have attended at this Institution classes on "Gas Manufacture" and "Gas Fitting," and I have proved time and again that the information gained has been of considerable use to me. I should like to point out that membership of this Association has carried with it the privilege of visiting other works under the very best auspices, and seeing much of the instruction above mentioned put to practical use. It is only by keeping our eyes and our ears open that we can hope to learn much. I have never failed to recollect the words of an eminent gas engineer, who attributed his success to the fact that "he studied what others considered to be trifles."

No doubt we are all aspiring to be gas managers; and it is well to remember that we must begin at the bottom of the ladder and work our way up, not forgetting that when we have reached the top, we have only begun our real career. Before, in our subordinate position, we had not much worry; we were then one of the multitude. When we are promoted, we must be head and shoulders above the ordinary workers, able to understand them and all their difficulties, and capable of forming our plans and directing them how to carry them out. Some positions of trust and responsibility necessitate a heavy laundry bill; but any gas manager can tell you that the white shirt is not the gas manager's badge of office. The manager is not without troubles Sunday and Saturday—in fact, he can hardly indulge in the white shirt even on a Sunday, for surely tar is by no means a good thing for clean linen. He may suddenly find some day, in the dead of winter, that some of the men have not turned out and others are not to be got; so, in order to prevent the place lapsing into darkness, he must buckle to, and take his share of rough work with the stokers.

My advice to those young men who aspire to positions of trust in the gas profession, either as managers or engineers, is to get into a good engineering workshop where they make a speciality of gas-works plant, and there, first of all, learn to be engineers. By "engineer" I do not mean a mere mechanic, for a mechanic is simply a machine; an engineer is more than that. While employed in the workshop, take every opportunity of attending classes and learning the theoretical side of your profession; but, if necessary, first of all get a good grounding in the elements of the English language and in mathematics, for many who join the gas profession have been set to work rather too young. I myself started to work at eleven years of age; and in many similar cases the elementary education must, of necessity, have suffered. But never despair. Forge ahead, and if failure does befall you, you have done your best. Begin the struggle for supremacy afresh, and do not let the mocking voice of previous failure discourage you in the fight.

The gas industry still keeps in the forefront; and, in spite of the adoption of electric light in many places, it is quite able so far to hold its own. But we have a stubborn war to wage with the electricians. They will not be idle so long as gas has the best of it; and I am confident that the near future will see a revolution in the production of electrical energy and lamps which will make them formidable rivals. Still, we must go one better. We do not live for honour and glory—we live to make a livelihood and to be able to exist; and if lighting is to be taken from us, what are we to do? We must not give in; we must persevere, and try to find another market for our wares, or alter our wares to suit the new market—that of cookers, gas-fires, and gas-engines. This can only be done by making gas of a suitable quality and price to meet the requirements of our consumers. I think the time has arrived when, instead of being conservative about our modes of procedure, we should always court the fullest inquiry, and be willing at all times to give the fullest information to those upon whom we are dependent and who are dependent upon us—viz., the public. We should aim at getting them to thoroughly understand the principle of incandescent gas lighting. We could then get many who are not so at present to become consumers. With the greatly improved forms of burners, both inverted and upright, upon the market, we have a means of encouraging people to burn gas. Above all, in seeking to deal with complaints, great tact is needed, and we should endeavour to give the utmost information possible, having first thoroughly acquainted ourselves with the working of all lighting and heating apparatus likely to be used by the public.

So much has already been said, that there is not much to add anent the introduction of labour-saving machinery in the gas industry. Some engineers seem to prefer inclined retorts, while others prefer horizontal retorts with machinery. Within the past year or so, there have been introduced into Scotland for the first time two new forms of stoking machinery—viz., that of Messrs. R. Dempster and Sons, adopted at Falkirk, and that of M. De Brouwer, introduced into the Alloa Gas-Works. So far, all reports of these machines seem to be satisfactory, and quite up to the promises of the makers. Some of us have inspected them at work in Falkirk; and I am sure we must all be favourably impressed with what we have seen and heard of them. It is therefore quite unnecessary for me to say anything further about them, as I understand that we may be treated to a paper on the subject by Mr. Rule, who is more competent to talk about them than I am.

Another matter that is engaging the attention of gas managers is the external and internal fitting of houses. Some companies supply and fit pipes to the meters, while others content themselves with just giving a connection from the main. Now, I am convinced that, if we want to give satisfaction, we should have the whole thing under our control, and therefore prevent in the near future all complaints as to bad gas, want of pressure, deficiencies, &c. Again, with regard to internal fittings. If the work is done by contract, it should only be carried out under the supervision of an inspector from the gas office.

With regard to our works at Lasswade, there is not much to record in the way of machinery; but we are making good progress, and have lately added to our list of consumers a large factory using 550 lights. On taking over the works, about 4½ years ago, the storage capacity was only 23,000 cubic feet, and there were being sent out of the works from 40,000 to 45,000 cubic feet of gas in 24 hours; so we had not much to boast of in the way of holder accommodation. Our repeated efforts failed to get a suitable piece of ground on which to erect a holder; so it was decided to take down an old one, from which we could only get about 3000 cubic feet, and put up in its place a small telescopic holder, which now gives us nearly 10,000 cubic feet. In pumping out the water from the tank (which I think holds close on 36,000 gallons), we used a hand pump, and were able to get it all out in about a week with our own men. Notwithstanding this addition, we are again in as much need of a new holder as ever; and with this in view, it is proposed meantime to make some alterations in the spring of next year, including the provision of a new bench of retorts containing two ovens of five retorts each, a new set of condensers, a scrubber, and a new gasholder. It is intended to erect the condensers and scrubber in the garden at the other side of the road, and place the gasholder close by the railway station.

It occurs to me that an account of our means of conveying coke to the railway station to be loaded into trucks might be of interest to the members. We have during the year more than 100 tons of surplus coke for sale; and to get rid of this we have to send it outside our locality. A difficulty presented itself at the start, as we have no loading-bank. We first tried putting the coke into carts and shovelling it out; but this proved a laborious and expensive operation. Then we tried filling it into bags, carting them to the station, and emptying the bags into the waggon. This was more easily done, and was not so expensive; but we still wanted something that would be quicker and easier, for it must be remembered that in a small works like ours the men are all fully employed during the winter months. After a good deal of consideration, I had a large box made that would hold about 10 or 12 cwt. of coke, and would fit into a cart. The box has at the bottom a door fixed by hinges and two catches, the latter being connected by means of a rod. Our mode of procedure is as follows: The box is put into the cart and loaded with coke. It is then taken to the station, where we lift it out of the cart with the crane. It is swung round on the top of the waggon to be filled, the rod is struck by the hammer, when the door swings open, and the coke drops into the waggon. While with either of the first two ways of loading the cost was about 1s. per ton for carting alone, by the latter method we can load a 4½ ton waggon for between 4d. and 5d.

Another small matter I might mention is that I have been in the habit of getting my retorts glazed, and I have proved the benefit of this by the fact that I have had three retorts working now for a whole twelvemonth, and have never needed to burn off any carbon, notwithstanding the fact that I have no exhauster, and that the back-pressure is from 3 to 4 inches. Since I took over the management of the works, the price of gas has been reduced three times; while the stokers have not been forgotten, and the Manager himself has had an annual vote of thanks and a bonus, accompanied on two occasions by an increase of salary.

It having been resolved to allow the address to be discussed,

Mr. A. Wilson (Glasgow), on the invitation of the President, said he had not come to the meeting to take part in the proceedings, but really to show his interest in the Junior Associations. It was considered not quite fair to discuss a Presidential Address; but they could thank the President for the one he had delivered. He (Mr. Wilson) thought he had given the business of the session a splendid start. The President took a very wide view, not of gas manufacture only, but of all the conditions of life. With much that he had said, he (Mr. Wilson) was entirely in sympathy. It was no hardship for young men to start at the bottom of the ladder, and work their way up. For one thing, they could deal with men in a much more frank and satisfactory way if they knew all the conditions of the work to be done. Men who were theoretical only were not able to gauge what a man was capable of doing. They were sometimes inclined to require an impossibility. When a man was asked to do something which he knew could not be done, he was apt to lose whatever good opinion he might have of those who were over him. There was a remark in the address about a white shirt. Well, a white shirt was a good investment for a gas manager, because appearance went a long way in dealing with customers.

Mr. J. Dickson did not know that there was very much matter for discussion in the address, but there was some very valuable information in it. The President's method of filling carts with coke was a very ingenious one. Although he could not boast of conveyors and elevators, he made the most of what came to his hand; and it was this that brought out the real engineer.

Mr. D. Bisset moved a vote of thanks to the President for his address, and it was heartily accorded.

The President returned thanks for the kind reception which the members had given him. He could not say that it had been a pleasure to him to deliver his address; but he had been well repaid in the remarks made by Mr. Wilson.

On the motion of Mr. J. R. Moyes, seconded by Mr. W. S. Easson (Selkirk), a resolution was adopted to the effect that the office-bearers of the Association be elected by open ballot at the annual general meeting. The present method of requiring nominations at least fourteen days prior to the meeting was felt to be costly and troublesome; but while it has been agreed that the election shall take place in the meeting, it was stated that it will be competent for any member who is unable to attend to send in a name to the Secretary, who will lay it before the members.

PETROL GAS LIGHTING IN SCOTLAND.

A recent number of the "Dundee Evening Telegraph and Post" contained an article, under the heading of "A New Illuminant," giving some particulars, quoted from "The Tribune," of a system of lighting by petrol gas which is now in use at Ceres, Cupar Fife. As might have been expected, the article contained several inaccuracies, which were promptly set right by the gentleman responsible for the system, who is no other than Mr. William Key, formerly one of the Gas Engineers under the Glasgow Corporation, and now known to many of our readers in connection with his system of heating and ventilation, which, as mentioned elsewhere, has been adopted at the new Old Bailey. Mr. Key wrote as follows:

Petrol gas is not a new illuminant, nor is its manufacture patentable. Anyone can, however, patent his own method of mixing petrol with air to produce carburetted air gas. I introduced petrol gas as a means of artificially lighting the houses in this village [Ceres] last year. The light is exceedingly brilliant, and costs less than half to consumers than electric light, comparing light for light. I have a light of 150-candle power in my dining-room, drawing-room, and a lamp over the entrance gate, by inverted mantles. The usual lights are, however, 70-candle power, and for penny-in-the-slot gas-meters 30-candle power. The air of the rooms certainly remains much purer during the lighting hours. But your article draws rather a flowery picture as to its cost. Petrol cannot be bought for anything like 1s. 10d. for 2¾ gallons; it is nearer double when delivered in ton lots. Nor does it go into many matters which must be considered at its introduction. The gas-pipes or street-mains cost something, and have to be much larger than for coal gas, which gets its air added in the burner, and the service-pipes, house-pipes, gas-meters all need to be much larger; and some account has to be taken of these and the men's wages to manufacture and put on and off pressure at proper hours, interest on capital outlay, expenses of attention to mains, services, gas-meters, leaks, and fittings, mantles, &c., consumers' gas-meter surveys, collections, and rent of premises in which to manufacture.

It appears that Mr. Key sends his petrol gas direct into two holders, and distributes it in the usual way. There are several miles of mains, and the houses of the consumers are far apart. There are only about 170 altogether, and they are very poor people. The price of the gas is 4s. 2d. per 1000 cubic feet. Before Mr. Key put up the coal-retort plant, he for two years had a splendid light—far better than that produced by high-pressure gas—as he introduced into the gasholders a large proportion of the air necessary for proper combustion. From one-fourth to one-third of the bulk of gas in the holders was air. He needed no high-pressure plant, as the brilliancy of the mantles was extraordinary. He does not know, nor do we, of any other place where petrol gas is sent out from the usual gasholders; and if any of our readers are aware of an instance of similar lighting to that at Ceres, we shall be glad to be informed of it, and to receive particulars for publication.

Nottingham Gas-Works Investigation.—Through a typographical slip, the word "undesirable" was rendered "desirable" in the fourth line of the third paragraph in the editorial last week on "The Report of the Nottingham Investigation Committee." The context will, however, have disclosed the error.

Society of British Gas Industries.—A meeting of the Gas-Stove Section of the Society was held last Friday at the Westminster Palace Hotel. Mr. F. W. Goodenough attended and explained the co-operative scheme between the Gaslight and Coke Company and the London ironmongers. The result was that an agreement in connection with the scheme was come to with the Company.

Midland Association of Gas Managers.—The next meeting of the Association is fixed for the 25th inst. at Birmingham, under the presidency of Mr Fletcher W. Stevenson, of Coventry. We learn from the Hon. Secretary (Mr. Charles Meiklejohn, of Rugby) that two papers will be submitted for the consideration of the members—one by Mr. T. Berridge, of Leamington, on synchronizing clocks by increasing the pressure of gas in the mains; and the other by Mr. Samuel Glover, of St. Helens, on the subject of his residual products works. The matter to be dealt with by Mr. Berridge has already been before the members; and Mr. Glover's communication cannot fail to be of interest.

THE "KHOMA" GAUZELESS BURNER.

The illustrations which depict with perfect clearness a new incandescent gas-burner patented by the Khoma Gas Arc Lamp Company, Limited, has such novel appearance that it will command attention. It will be observed that the gas and air mixture has to pass from the nipple up a bunsen greatly restricted at its lower part in comparison with the ample dimensions of its upper part, and all such arrangements as these cannot fail to have an excellent blending effect on the gas and air—their thorough admixture, of course, producing a marked improvement on the flame. At the upper part of the burner are features special to this burner in the combination of parts. There is a cone deflector; and the cap of the burner, instead of being provided with the ordinary form of gauze or perforated head, is made with

Sectional View of the "Khoma" Burner.

View of Top.

fairly deep circular metal partitions, which get hot, and in turn impart heat to the combustible mixture as it passes through the narrow concentric orifices. Now it will be seen that there are no obstructions to the travel of the mixture through the burner, and that the cone deflects the mixture into the narrow openings of the head, and, in fact, tends to accelerate the flow. The effect of this method of construction is to give a circular flame of good volume. Flame volume has been urged lately as an essential to the securing of the greatest efficiency from a mantle; and that is what the "Khoma" Company have sought to produce, with at the same time, through the securing of perfect combustion, a flame of high temperature. There is no doubt that the giving of a mantle the greatest possible surface of flame is an effective way to obtain excellence of illuminating power. In addition to these advantages, the burner, under the conditions of trial, was quite silent. It will be remarked from this description that the burner has no gauze to wear out, or become clogged with carbon or dust. The top of the burner, too, can be readily lifted off, together with its mantle and rod, and placed upright on a table without the danger, owing to the wide base, of falling over. The burner is strongly made, and looks practically indestructible. It is now being used on the "Khoma" indoor and outdoor four-burner lamps; and there is no question that it will give a good account of itself.

LARGE GAS-ENGINES.

By H. A. Humphrey, M.Inst.C.E., M.I.Mech.E., &c.

[A Lecture, with Lantern Slides, delivered in connection with the Engineering and Machinery Exhibition at Olympia, Oct. 4.]

The Nineteenth Century was the century of the steam-engine; but the Twentieth Century promises to be the century of the gas-engine. All are familiar with the small gas-engine which exists in tens of thousands through the civilized world; but the Twentieth Century has seen the growth of the large gas-engine, which can now be had in units up to 4000-horse power. During the last few years, the large gas-engine has come boldly to the front as the most economical of all prime-movers, and has entered upon an era of success from which it will not look back. A high-class modern gas-engine, using producer gas, will develop one indicated horse power for 0·65 lb. of anthracite coal. A modern steam-engine needs 1·2 lbs. of coal to give the same power. These figures are such as have been obtained under test; and slightly better results even have been recorded. Under favourable working conditions, a large gas-engine develops a horse-power-hour for 0·8 lb. of coal; and a steam-engine, under similar conditions, takes about 2 lbs. But if we turn to common practice under average factory conditions such as are found in this country, where the power units are comparatively small, we find the gas-engine giving an indicated horse power for 1 lb. of coal, or a little over, and a steam-engine consuming four times as much. As a motor for converting heat into mechanical work, the gas-engine is therefore twice as efficient as the steam-engine.

Until the advent of the Dowson producer, gas-engines worked only with illuminating gas. In our days, such fuel is far too costly for any but small engines. Larger engines now use suction gas or Dowson gas made from anthracite coal; and when the power gets sufficient to warrant the outlay, a Mond or other bituminous coal producer plant is installed to utilize the cheap slack which forms so large a portion of the output of our own coalfields. By the process introduced by Dr. Mond, the production of gas from bituminous coal is made the occasion for the recovery of bye-products from the coal; and when such plant is worked in conjunction with a power station, the total cost of power with gas-engines is less than half that with steam-engines. Personally, I know of several cases where large gas-engines and modern steam-engines are working side by side under the same roof, under equally favourable conditions, and where the comparative costs are even more in favour of the gas-engine than those just mentioned. Here, then, we have what are usually called the "works cost" per horse power, or per unit of electricity as the case may be, 100 per cent. more for the steam-engine as compared with the gas-engine; and this comparison will hold wherever the load is large enough, and the load-factor good enough, to enable an ammonia recovery plant to be installed in connection with the use of gas-engines, and where suitable cheap slack is obtainable.

If one bears in mind the fact that the population of the world is increasing, while the available coal supply is decreasing, and that consequently there are more people to be fed while coal is becoming dearer, the great advantage of using our coal so that it develops twice as much power, and incidentally provides a large supply of sulphate of ammonia, which is one of the best fertilizers for growing crops and food stuffs, will be obvious. All this is of practical importance in considering the relation of prime movers to one another; and it must not be forgotten that in an installation where gas-engines are employed no smoke is produced.

I am not, in this lecture, going to attempt any lengthy historical survey of the development of the gas-engine; and I propose to limit what I have to say to large gas-engines, as the features of the small type must be almost as well known to those in this room as is the working of a steam-engine. The first large gas-engines in this country (above 400-horse power) were put down under my supervision at the works of Messrs. Brunner, Mond, and Co., at Northwich. One was a 400 to 450 horse power Crossley gas-engine, having two cylinders arranged *vis-à-vis* fashion, each 26 inches diameter by 36 inches stroke, and running at 150 revolutions per minute. The other was a Premier gas-engine having the two cylinders arranged tandem fashion; the size between 28½ inches diameter by 30 inches stroke, and the speed 125 revolutions per minute. These two types of engines constituted for some years practically the only kinds of large gas-engines to be found in this country. Later on the Premier Company produced an engine with a separate scavenger cylinder on top, and having the valves not only opened but also closed positively. It is only recently Messrs. Crossley Bros. have been in a position to put on the market a double-acting engine, which is more in conformity with Continental ideas.

The first person to take his courage in both hands and to design, build, and run a gas-engine with a large diameter piston was M. Delamare-Debouteville, whose name deserves to rank along with those of Otto, Langen, and Lenoir in the history of the gas-engine. I shall never forget seeing the first large Simplex gas-engine running at the Pantin Mills, in France, in 1892; and probably no single forward step towards the production of large gas-engine units was ever of greater importance than that mentioned. The engine was, in those days, a real monster; and had a piston diameter of 34·5 inches and a stroke of 39·4 inches. Of course, it attracted great attention; and, in spite of its many troubles, it must be considered a success, in so far as it demonstrated the possibility of obtaining 300-horse power from a single cylinder single-acting gas-engine. Later on, the John Cockerill Company, of Seraing, in Belgium, took up M. Debouteville's patent; and in 1900, at the Paris Exhibition, the engineering world was surprised to see another Simplex engine of the same type but of double the horse power in a single cylinder. This engine had a piston diameter of 51·2 inches, and a stroke of 55·1 inches, and ran at 95 revolutions per minute.

Apart from the work of Messrs. Crossley Bros. and the Premier Gas-Engine Company, already mentioned, the only other English productions of importance for the purpose of this lecture are the large gas-engines made under licence from Continental firms. Thus, Messrs. Richardsons, Westgarth, and Co., of Middlesbrough-on-Tees, took up the manufacture of Cockerill engines; Messrs. Mather and Platt took up the manufacture of Körting engines; Messrs. Beardmore and Co., of Glasgow, started to build Oechelhaeuser engines; and recently the Lillieshall Forge Company have entered into a contract to build Nurnberg engines. From the time, therefore, that Messrs. Brunner, Mond, and Co. made their important experiment in the running of an electrolytic plant with large gas-engines, we have to turn almost exclusively to the Continent if we wish to study the progress of

the large gas-engine; but before doing so I would remark that there are vertical types of English engines which were successful up to moderate powers. These are made by the Westinghouse Company, Messrs. Tangyes, Messrs. Fielding and Platt, and others. Many excellent designs of ordinary horizontal Otto-cycle gas-engines made by English firms are, as already explained, excluded from the scope of this lecture.

We are now in a position to consider the Continental gas-engines; and, as I have already mentioned, the Cockerill engine was among the first of the large gas-engines to come into general use. The Cockerill Company, having made the single-cylinder engine a success, saw the advantage, both from cheapness of construction and uniformity of turning moment, in making a tandem engine, and their next step was to produce an engine in which both cylinders were still single acting, with their pistons connected by a piston-rod; and also a larger engine of the same type with a blowing cylinder attached. Previously, attempts to make a stuffing-box gas-tight under the great pressures and high temperatures to be found in gas-engine cylinders had not been very successful. But when this problem had once been solved, the way was open to a double-acting Otto cycle engine; and now the majority of the Cockerill engines are of the double-acting type.

The Gasmotoren Fabrik Deutz, near Cologne, made small gas-engines for Germany by the hundred, just as Messrs. Crossley Bros. did for England. The first Deutz engines of large size were of the *vis-à-vis* type. In their 500-horse power engine, the cylinders are single acting, the pistons are of the trunk type, and the connecting-rods work on to a common crank. It is, in fact, the same type as the large Crossley engines; and the Deutz people were the originators of it. Another engine, of 1000-horse power, has two pairs of *vis-à-vis* cylinders working on to a common crank-shaft, and drives an alternator at its centre. A somewhat larger engine, of similar design, at Horde, drives an alternator in parallel with other alternators. This is one of the engines which attracted great attention to the possibilities of using blast-furnace gas to supply alternating current for use in a steel-works. The Deutz Company no longer make this kind of engine, having turned their attention to the double-acting Otto-cycle type.

Perhaps one of the most successful of the large gas-engine builders abroad is the Nurnberg Company, who originated the type of tandem double-acting engine working on the Otto cycle, which has been more copied than any other gas-engine, and which may be considered the prevailing type at the present time. An explosion occurs on each side of each of the two pistons; so that, remembering that the Otto cycle only gives one impulse every two revolutions, we have the four cylinder ends giving together two impulses every revolution. In other words, the steadiness of the turning moment is practically equivalent to that of an ordinary double-acting steam-engine with one cylinder. Further, as the four explosions take place at equal intervals, and as there is a compression stroke to take up the inertia of the reciprocating parts every time they have to be brought to rest, the connecting-rod and crank-shaft need to be no stronger than for a single-acting tandem engine of half the power.

The development of large gas-engines on the Continent was carried forward almost exclusively in connection with the use of blast-furnace gas; and among the early troubles of large gas-engines were those resulting from the dust carried from the blast-furnaces in this gas. The Oechelhaeuser engine was an invention which did away with the ordinary inlet and exhaust valves, and so overcome some of the troubles mentioned. In this engine there are three cranks, the two outside being connected through a cross-bar to the rear piston, and the centre crank being connected to the front piston. Both pistons work in a long cylinder open at either end; and with all three cranks in the horizontal plane, these two pistons are at their maximum distance apart. Also connected to the back piston is the pump, which blows air on one side and gas on the other, and delivers these to the two lots of ports respectively. The burnt gases escape through a ring of exhaust ports, and are further swept out by pure air from the pump. Then follows into the cylinder a mixture of gas and air. Half-a-revolution of the engine brings the two pistons close together, and compresses the explosive mixture in the centre of the cylinder. Explosion now occurs, driving the pistons apart; and while the centre crank is pushed, the outside cranks are pulled in such a way as to produce an almost balanced turning moment on the crankshaft. I have seen Oechelhaeuser engines of 2000-horse power working smoothly and successfully.

A great stir in the gas-engine world was made when Messrs. Körting Bros. exhibited their first double-acting two-cycle engine. The idea was to produce a gas-engine which should have the regularity of the steam-engine—that is, one which would give an impulse each stroke and on both sides of the piston. Like the Oechelhaeuser engine, it has no exhaust-valve, the piston uncovering a ring of circular ports in the centre of the cylinder. Also like the Oechelhaeuser engine, the gas and air are both pumped into the working cylinder under pressure; but, in order to get an explosion every stroke, it is necessary to have two pumps—one for gas and one for air. The two pump-chambers on the left-hand of their respective pistons deliver gas and air into the left-hand inlet-valve of the working cylinder; and the two right-hand chambers deliver into the right-hand end.

The cycle of operations is briefly as follows: With a piston to the right, the burnt gases from the left-hand end of the working cylinder have exhausted through the ports in the centre. Then comes first a supply of air through the inlet-valve, and then gas and air still further driving out the products of combustion. The piston now returns, closes the exhaust-ports, and compresses the charge—the inlet-valve being shut. Ignition occurs, and the working stroke takes place. As the power of the engine decreases, less gas is required per stroke; and two small bye-pass valves are manipulated by the governor gear and determine how much of the gas forced by the gas-pump shall pass into the motor cylinder or be bye-passed back to the supply-pipe.

As the Körting engine has been constructed by various licensees, several departures from the type described have been made by them. Perhaps the most noteworthy is that introduced by Messrs. Mather and Platt for small engines. They have greatly simplified the construction; two air-pumps, with automatic valves, and one central gas-pump being substituted for the old arrangement. Also by the use of a hollow piston for the gas-pump no controlling piston-valve is now required; and, further, the cam-shaft has disappeared, and been replaced by an eccentric and tappet arrangement.

There are now in Germany alone 24 manufacturers of large gas-engines, most of them making the tandem double-acting Otto-cycle type, either alone or in conjunction with another type. Considerable competition has brought about many minor changes and improvements; and the designs show the result of considerable inventive skill and great care for details.

In choosing the gas-engines made by the firm of Messrs. Ehrhardt and Sehmer, of Saarbrucken, as representing modern up-to-date practice, I wish it to be understood that there are other engines of equal merit which must be excluded on account of the shortness of time at my disposal. Like many other makers of gas-engines, Messrs. Ehrhardt and Sehmer were originally best known in connection with the construction of large steam-engines and pumps; and many of the recent improvements have had the effect of bringing the gas-engine more into line with the steam-engine. A 600-brake horse power engine of standard type, which is made in units up to 2000-horse power, is working at Heinitz with coke-oven gas, and developing up to 750-horse power. An engine of 1500-brake horse power is installed at Homecourt, in France. The Ehrhardt and Sehmer engine, in common with so many others, has the inlet-valves arranged in a line along the top of the cylinder, and the exhaust-valves at the bottom. The pistons are water-cooled; and the whole of their weight is taken by means of the three bearing surfaces at the crosshead, the intermediate guide, and the back slipper. The concentric system of fitting is adopted, so that the working stresses are evenly distributed and are parallel to the main axis of the cylinder. Another advantage of this arrangement is the great accessibility of all parts.

There is one more type which should not be omitted from a description of Continental gas-engines. It is that known as the Dingler engine, and is manufactured at Zweibrucken. The peculiarity of this engine consists principally in having two open-ended working cylinders with their combustion chambers back to back and bolted together, but containing between them a long water-cooled gland through which passes the piston-rod that connects the two pistons. The simplicity of parts to which this gives rise, and the accessibility of the pistons at all times may be admitted; but, in order to get impulses equally timed, it would be necessary to put two such pairs of cylinders in tandem. Otherwise it has the disadvantage of a *vis-à-vis* engine—namely, that it involves having two working strokes followed by two idle strokes. The Dingler engine has other novel features in connection with the valve gear, which I have not time to go into. At present only gas-engines up to 350-horse power have been made of the Dingler type; and I merely mention it among the large gas-engines because it is intended in the future to construct engines on this principle up to 2000-horse power.

It must have struck you that I have had very much more to say about Continental gas-engines than about English ones; and I have been frequently asked why England, which was once well to the front, allowed practically all the progress made in large gas-engines during the last few years to take place abroad. Undoubtedly, the reply involves numerous points. In the first place, the manufacture of large gas-engines has only recently commenced to pay. Those enterprising firms to whom we owe the modern large gas-engine all lost money in the early years of their work in this department. Large-scale experiments are always expensive; but the Belgians and the Germans realized that the advent of the large gas-engine was a certainty, and plodded away through all the early troubles and heavy financial losses until they reached success. English makers had similar early troubles, and probably, in the interests of their shareholders, thought it advisable to go slowly. Again, though the application of blast-furnace gas to engines first took place in this country on a small scale, the magnitude of the possibilities involved was more quickly appreciated on the Continent, and there were found not only the people to make the engines, but, what is of equal importance, the iron and steel masters who would use them when made. The grey hairs and sleepless nights of the Continental works managers, who had charge of the early gas-engines in some of the large steel works, counted for little so long as the engines really effected a considerable monetary saving in the production of iron and steel. Indeed, I am informed that the use of gas-engines and the electrical equipment of the rolling

mills, &c., has reduced the price of the finished products by 13s. to 18s. per ton. Then, in Germany coal is dearer than in England; and the necessity for economy in fuel presses more heavily upon the German than upon the English steel maker. As the final reason, I may state that the more important types of gas-engines are all Continental inventions; and it is therefore natural that they should be evolved and perfected in the country of their origin. At the present day, all the early troubles have been overcome; and a modern large gas-engine is as reliable as a steam-engine of equal size.

In 1902, I made a list of all the large gas-engines which were then known; and, including with this country and the Continent those engines in America, the list gave 327 gas-engines with a total of 181,606-horse power. Please remember that this was only four years ago. Figures taken from three papers recently read at the Iron and Steel Institute, show that, excluding America and France, there are now 531 gas-engines, having a total of 544,240-horse power. The returns are not complete, because those on the Continent only deal with gas-engines in iron and steel works and collieries. They, however, serve their purpose in indicating the enormous advance which has taken place.

LEGAL INTELLIGENCE.

HIGH COURT OF JUSTICE—CHANCERY DIVISION.

Wednesday, Oct. 3.

(*Before Mr. Justice* BARGRAVE DEANE, *Vacation Judge.*)

Hastings Tramway Company v. Hastings and St. Leonards Gas Company.

This was an application to restrain the defendants from proceeding further with an arbitration; and it raised a short point of law under the Tramways Act, 1870.

The plaintiffs are laying tramways under the power conferred by their Act of 1903, which incorporated the Act of 1870; and they had to give seven days' notice to the road authorities before breaking up the road, which had to be reinstated within one month. The Act gave plaintiffs power to alter the position of any gas-mains, subject to the restriction of giving seven days' notice to the Gas Company and depositing plans; and if it appeared to the latter Company that the construction of the tramway would endanger their distributing plant, they were authorized to give notice to the Tramway Company to lower or alter the position of the mains or pipes—any difference as to the necessity for such lowering or alteration to be settled by arbitration in the manner provided by section 33. On the 1st of June, the plaintiffs gave the required notice and deposited plans; on the 6th of July, the Gas Company gave a counter-notice, requiring a certain depth of concrete to be placed under the lines; and on the 25th of that month, application was made to the Board of Trade to appoint an Arbitrator in the matter. For the plaintiffs it was contended that the defendants were bound to give any counter-notice within seven days of the original notice, or else lower the mains at their own expense. The defendants urged that it was not the practice of the Court to grant an injunction on an interlocutory application, and that the arbitration ought to be allowed to proceed.

His LORDSHIP held that the plaintiffs were wrong in their contention as to the construction to be placed on the Act; and he refused the application, with costs.

CHARGE FOR WATER FOR FIRE EXTINCTION.

A case of considerable interest to the owners of water undertakings recently came before Judge Bradbury in the Oldham County Court. It was an action brought by the Corporation to recover from the Lancashire and Yorkshire Railway Company a sum of £72 4s. 1d., the balance of an account for water. The following were the agreed facts submitted to the Judge for his decision.

The defendants are the owners of a railway goods depôt situate at Werneth, Oldham, and also of a similar depôt situate at Royton Junction. The plaintiffs are the water undertakers for the borough and surrounding districts, and supply water to the defendants at both of the depôts; the water so supplied being in each case measured by meter, and paid for at a rate per 1000 gallons according to a scale of charges in force. Water-mains belonging to the plaintiffs are laid in roads adjacent to the Werneth Depôt, and the plaintiffs have fixed and maintained upon them proper fire-plugs at convenient distances for use in extinguishing fire, and have kept their mains properly charged with water. The defendants have, for the further and better protection of their premises against fire, fixed a number of fire-plugs on the private service-pipes laid in the yard of their Werneth Depôt, which are supplied from the plaintiffs' main. Prior to 1893, certain fire-plugs fixed on the defendants' premises at Werneth were fed direct from the plaintiffs' main, and not through meter; and the defendants paid to the plaintiffs the sum of £1 per annum for each plug so fixed. Since the above-named year, all the fire-plugs fixed on the defendants' premises have been fed with water through a meter fixed on their private service-pipe, owing to the plaintiffs having ceased to supply hydrants on private premises with water direct from the Corporation mains.

On May 11, 1905, about 4.30 a.m., a fire broke out in the cotton warehouse at the Werneth Depôt; and this building at the time of the outbreak contained about 4500 bales of cotton. In addition to the water used direct from the plaintiffs' mains through their fire-plugs, a considerable quantity was employed in extinguishing the fire from the private fire-plugs on the defendants' service-pipes. As soon as practicable after the fire had been got under control, the bales of cotton stored in the said warehouse were removed to the Royton Junction Depôt. After the fire a very large quantity of water was poured upon the damaged cotton, both at Werneth and Royton Junction, for the purpose of preventing any fresh outbreak; the water so used being obtained from the defendants' private service-pipes, and passed through, and was registered by, the water-meters fixed on their respective premises. The defendants deducted from the water-charges rendered for the quarter ended June 25, 1905, the sum of £72 4s. 1d., being the value, as estimated by them, of water which was used in connection with the extinguishment of the fire, and which they claim they were entitled to use without payment. The sum named is that which the plaintiffs are seeking to recover from the defendants. The value of the water used at the Werneth Depôt in extinguishing the fire, and in afterwards preparing the damaged cotton for sale, is agreed at the sum of £33 7s. 6d. The value of the water used at the Royton Junction Depôt is agreed at the sum of £27 3s. 7d. The defendants admit that a sum of £11 13s., part of the sum of £72 4s. 1d. deducted by them for water believed to have been used in connection with the fire through their meter at the Mumps Station, was wrongly deducted; no part of the damaged cotton having been deposited at that station.

The questions for decision were whether the defendants were entitled to use without payment the water taken from their private service-pipes at the Werneth and Royton Depôts for the extinguishment of the fire, and (2) in connection with the damaged cotton.

The case for the Corporation was conducted by Mr. Acton (instructed by Mr. J. H. Hallsworth, the Town Clerk), who read the above statement, and said the point to be decided was whether the Railway Company were entitled by statute to take without payment the water for extinguishing fire. The question turned upon the construction of sections 38 to 42 of the Water-Works Clauses Act, 1847, section 260 of the Oldham Borough Improvement Act, 1865, and sections 2 and 22 of the Oldham Borough Improvement Act, 1880. Having quoted the words of these Acts, he submitted that this group of sections gave permission for the public to take water from a public fire-plug without compensation, but not from private service-pipes. He cited in support the decision in the King's Bench Division, in 1904, in the appeal from the Durham County Court in the case of *Weardale and Consett Water Company v. Chester-le-Street Co-operative Society.** Mr. Turner, who appeared for the defendants, argued at length that the statute gave the Company the right to take the water through their private service-pipe for fire-extinguishing purposes precisely as it did to take the water from one of the public fire-plugs, the provision of which was incumbent upon the Corporation by the Acts, as a condition of the trading concession, without charge.

His Honour said his view of the intention of the Legislature was that a proper supply of water should be available for fire purposes, and that this proper supply was the street-mains and the fire-plugs there. If a user wished to have upon his premises a protection greater than that which was provided for him free of charge by the statute, he must be prepared to pay for it. He gave judgment for the Corporation, with costs.

THE OWNERSHIP OF MONEY IN SLOT GAS-METERS.

A London Magistrate's Views.

At the Old Street Police Court, on the 29th ult., a man living in Meadow Road, Hackney, was charged before Mr. Biron with abstracting money from, and doing wilful damage to, a gas-meter, the property of the Gaslight and Coke Company. The case presented only the ordinary features; but it is of interest in consequence of some remarks made by the learned Magistrate in the course of the hearing. It appeared from the evidence that, when the collector called, he found that 3s. 8d. was missing from the money-box, and that the padlock of the meter had been broken and removed. When arrested, the accused acknowledged he had broken open the meter the previous Friday.

Mr. HUMPHREYS appeared for the Company.

Mr. BIRON (to Mr. Humphreys): Why do you say it is the Company's property? It is the man's property, is it not? It is his money?

Mr. HUMPHREYS: When the money is put into the box, it belongs to the Gas Company.

Mr. BIRON: But the box is not in their possession at the time.

Mr. HUMPHREYS: The meter is, to all intents and purposes, the Company's. It is the same as if the accused put the money into the collector's hands and then knocked him down and took it back.

Mr. BIRON: I don't think it is. I have grave doubts about it. This money put into the meter is the man's own money. A man is willing to pay ready money for the gas used, and he says: "I will pay this ready money on a later occasion," and puts it by.

Mr. HUMPHREYS: He does not steal the gas, but he steals the money he has paid, or put into the meter, for the gas. The meter is from the first the Company's. It is, in a sense, their till; and any one taking money from it is really stealing from the till.

Mr. BIRON: You say the meter is merely there to hold the money in a state of suspended ownership. When you say that the meter is yours, has it ever been in your possession at all?

Mr. HUMPHREYS: It has always been held that the meter is, to all intents and purposes, the till of the gas company.

MR. BIRON: It makes a great difference when the money put into it is a man's own money, put in as a convenience for deferred payment.

Mr. HUMPHREYS: It is not his money when he has had the gas.

Mr. BIRON (who here seemed to recognize the force of the argument adduced for the prosecution) said it appeared that the Gas Company dealt with poor people and were obliged to make arrangements to protect themselves. The supply of gas on slot-meter terms was no doubt an enormous convenience to the poor, who without some such system could not enjoy the luxury of burning gas. It was manifestly, therefore, in the interests of the poor themselves that the company providing the facilities should be protected against fraud and robbery. It was no doubt a very special arrangement, and he was not sure that the abstraction of some portion of the money put in was not a larceny. But, without deciding this point, he felt more inclined to deal with the case as one of wilful damage only. For damaging the meter he would fine him 10s., and 2s. 6d. for the damage to the padlock.

* See "JOURNAL," Vol. LXXXVI., p. 319.

CORRESPONDENCE.

[We are not responsible for the opinions expressed by Correspondents.]

Blending of Producer Gas and Coal Gas.

SIR,—I have read with great interest Mr. Anderson's letter on the above subject in your last issue, and his remarks on my article published in the "JOURNAL" for Sept. 18.

From Mr. Anderson's letter, it appears that really the only point of importance on which we differ in opinion is with regard to the effect of the addition of producer gas to coal gas on the flame-temperature of the mixed gas; and I have much pleasure in acceding to his request to give more fully my reasons for believing that the temperature of such flame is thereby lowered.

Mr. Anderson's reason for the contrary view is that he regards the flame-temperature as dependent only on the calorific power of the gas, on the quantity of the products of combustion (including the nitrogen necessarily drawn in with the required oxygen), and the specific heat of these products. As the blended gas requires a smaller quantity of air for its combustion, and yields a much smaller quantity of products of combustion, he is of opinion that the flame-temperature of this gas will be the higher in spite of the reduction in calorific power, and suggests that I should calculate from the above data the temperature of flame attainable with both the blended and the unmixed gas.

I intentionally refrained from doing so in my previous article, because, in the first place, the values of the specific heats of the gases at high temperatures are not known with any certainty; and, in the second place, because, even if they were known, the theoretical temperatures thus calculated are valueless for practical purposes, inasmuch as they fail to take into account another and most important factor in determining the flame-temperature of a gas-jet burning in the air. This factor is the rate of combination between the combustible constituents of the gas and the oxygen of the air, and is one the value of which cannot be computed, as it varies greatly according to the composition of the gas and the conditions under which it is burnt—such as the pressure of the issuing gas and the construction of the burner.

Reliable figures as to flame-temperature can only, therefore, be obtained by direct experiment, and not by calculation; and in making comparison of the effect of the addition of an inert gas, such as nitrogen, the two gases must be burned as far as possible under parallel conditions. When this is done, it will be found that the addition of the inert gas in fact causes a considerable reduction in the flame-temperature. Two examples from actual practice; representing the two chief types of flame, will make this clear; and these tests can be readily repeated.

Consider, in the first place, two gases, one consisting of coal gas, and the other the same gas which has been diluted with 5 per cent. of some inert gas, such as nitrogen or carbonic acid. If the former is burnt at a constant rate, it gives a flame of a definite and constant volume. If then the diluted gas is burnt in the same burner at the same rate, it is at once seen that the flame volume is considerably increased; and as the calorific power of the diluted gas is 5 per cent. lower than that of the unmixed gas, it follows that in a given time a smaller number of heat-units is evolved in a larger space with the diluted gas, and that therefore the average temperature of that space—*i.e.*, the flame—must be lowered in greater proportion than the calorific power, and this in spite of the fact that the diluted gas requires less air for its combustion. This reduction in temperature is also shown by the fact that the light of the flame of the diluted gas has a yellower colour than that of the undiluted sample, showing that the solid particles in the flame are not raised to so high a temperature in the former case. Both these phenomena—namely, the increased size of the flame and the yellower colour—are very familiar to all who have tested the illuminating power of gas before and after the removal of the carbonic acid.

In the second case, a similar test may be made with the bunsen flame, in which a certain amount of primary air is added to the gas before combustion; any ordinary bunsen burner with adjustable air supply being used. To obtain parallel conditions, the primary air supply must be adjusted in both cases to such an extent that luminosity is just destroyed. And here again it is found that the diluted gas, in spite of its lower calorific power, gives the larger flame, so that with this type of flame also the reduction in average flame-temperature is greater than that of the calorific power.

The reason for the reduction of flame-temperature when inert gas is added to it, is that the gas thus added gets in the way between the molecules of combustible gas and the oxygen molecules, so that the combination requires a longer period for completion—thus resulting in a larger flame. In fact, adding nitrogen to the gas has just the same effect as increasing the percentage of nitrogen in the air would have. If, on the other hand, the dilution of the coal gas is carried out with blue water gas, which contains about 90 per cent. of combustible and 10 per cent. of inert gas, similar experiments show that the flame-volume is decreased proportionally to its calorific power or even more; so that in this case the average flame-temperature of the mixed gas is as high as or higher than that of the unmixed gas. In Mr. Shadbolt's method, the added gas is two-thirds inert gas and one-third combustible; so that the lowering of the flame-temperature would be less marked than when only inert gas is added.

I have not had an opportunity of making parallel experiments to the above with such gas, but have no doubt that when made they will show that even here the average flame-temperature is reduced by the addition in greater proportion than the calorific power; and for this reason I believe that such a procedure will tend neither to advantage nor to greater satisfaction on the part of the consumer.

With regard to the calculation of the relative costs of obtaining a lower-grade gas by dilution with either producer gas or water gas, it is somewhat difficult to give reliable figures as to the cost of the latter, so little having been published on the point; and, of course, in small works, such as those referred to by Mr. Anderson, the cost of blue water gas would very likely be too high. But for moderate-sized works the figures available appear to show that there would be but little difference in the total cost of production whether water gas or producer gas was used for the purpose.

Reverting to the actual illustration in my previous article, it was calculated that by mixing 11,000 cubic feet of coal gas of 570 B.Th.U., costing 1s. per 1000, with 1000 cubic feet of producer gas of 120 B.Th.U. at 0·75d. per 1000, 12,000 cubic feet of gas of 533 B.Th.U. would be obtained at an average cost of production of just over 11d. per 1000. The cost of blue water gas has been variously given as 4d. to 5d. per 1000; but for this calculation a cost of 5·5d. will be assumed. If the above volume of 11,000 cubic feet of coal gas of 570 B.Th.U. be mixed with 2000 cubic feet of blue water gas of 300 B.Th.U., costing 5·5d. per 1000, 13,000 cubic feet of gas of 529 B.Th.U. will be obtained at an average cost of just 11d. per 1000. [In both cases the increase in calorific power due to benzene taken up from the tar is ignored, as this is so small, and would be about the same in both cases.] The average cost of manufacturing gas of the same calorific power by the two methods is, therefore, practically identical under the conditions specified.

It is true that the necessary capital outlay would be greater for the production of the blue water gas than for the producer gas. But, on the other hand, when the former is used, 13,000 cubic feet of gas are produced for each ton of coal carbonized, against 12,000 cubic feet where producer gas is used; and to this must be added the fact that the flame-temperature of the former gas under working conditions will be decidedly higher.

1, *Arundel Street, Strand, Oct.* 4,1906. HAROLD G. COLMAN.

Coke and the Cement Trade.

SIR,—In your issue of Oct. 2 you commented on the fact that there had been a better demand for coke among the cement makers, and you considered there was reason to hope that a good period was in sight. As one who has had considerable experience in designing and constructing cement works on the Continent, I venture to think that your hopeful anticipations will not be realized. The days when coke was largely used for burning cement are passed; and in all probability the £211,000 referred to by Mr. F. A. White, the Chairman of the Amalgamated Portland Cement Manufacturers, as having been spent in developing and perfecting new plant, has been mainly disbursed in the erection of more modern and economical kilns, in place of the old bottle-kilns with which nearly all British cement works were till a few years ago, fitted.

With these old-fashioned kilns—burning over 50 per cent. of coke—it was and is quite impossible to compete with the Continental works (principally German and Scandinavian) fitted as they are with the latest developments in kilns on the Rotary (American), Dietsch, Möller, and Schaëffer systems.

The bottle kiln was intermittent in its action—that is, it had to be charged and drawn at intervals; and before taken again into use, it had to be cooled down—the whole being a long, tedious, and wasteful business. Furthermore, owing to the gases evolved, it could only burn coke, or, at any rate, a large proportion.

Now, the modern kilns, which are all more or less continuous in action, burn slack coal; and with a well-constructed kiln the consumption of coal dust or slack does not exceed 25 to 28 per cent., and practically it can be bought as cheaply as, perhaps cheaper than, London coke. Therefore, the time when coke played an important part in cement manufacture may be considered as past.

It has been said that the London Gas Companies, who formerly numbered the cement manufacturers among their most profitable customers, did little to foster the trade, but preferred to export cheap coke to the Continent rather than give the local cement manufacturers the benefits of the low prices. But whatever their policy may have been, they could not stave off the day when the cement factories were driven by competition to adopt the most economical kilns to be found on the market.

There is another matter which you, Sir, referred to, and that was the growing use of reinforced concrete. I have been for years astonished that so little has been done in England in this direction compared with the enormous strides made abroad during the last ten years. This system—the invention of a French gardener—was originally called the "Monier;" and I had the privilege of reading a paper on the subject some years ago before the Institution of Gas Engineers. The paper pointed out the advantages of this method of construction, especially as applied to gas-works; but, as far as I am aware, no efforts of importance have been made in this direction.

The Americans have had telling experiences at Valparaiso and San Francisco during the late calamitous periods; and the reconstruction of these cities will see armoured concrete extensively employed. The largest cargo of Scandinavian cement ever shipped (some 6000 tons) was recently dispatched from Sweden to America.

If our British cement companies would only interest themselves earnestly in this method of construction, they would soon be able to work up a profitable local market for their cement.

19, *Queen Anne's Chambers, Oct.* 6, 1906. F. D. MARSHALL.

Mr. Brockway and the Settle-Padfield Retort System.

SIR,—You will quite understand that the article dealing with vertical retorts in the "JOURNAL" this week has had our careful attention.

We are astonished to learn the opinion to which Mr. Brockway, of Cleethorpes, gave utterance. After having had the pleasure of seeing this gentleman at Rotterdam, and having had a meeting with him about the vertical-retort system of Settle and Padfield, Mr. Brockway told us that he was "very particularly satisfied with the system." He experienced some difficulties with the plungers, and found some lampblack; but, on the other hand, the results obtained were over 14,000 cubic feet of gas per ton of coal carbonized.

At the same meeting Mr. Brockway told us that his Board of Directors were allowing him to spend a considerable sum of money for continuing the experiments with the Settle-Padfield system.

We quite agree with you when you say that the Exeter bench was only an experiment; and so we are very careful in publishing results that we ourselves have secured. What we can at present report, after our latest experiments, is: The plunger system cannot be taken up in practice, but we have made considerable advance in carbonizing since Mr. Brockway's visit, and shall start our bench in a short time with a quite new system of continuous feeding.

The results obtained by Mr. Brockway at Cleethorpes, as he told us, are exactly what we found here; and it was very encouraging for us to meet that gentleman and hear his opinion (which was so satisfactory) of the Settle-Padfield system.

Of course, we do not want any particular encouragement, as we have our own opinion on the subject, which is that we trust shortly to arrive at satisfactory results without changing the original system.

Rotterdam, Oct. 4, 1906. ELSTER AND CO.

The Gas Exhibition at Manchester.

SIR,—It was with regret that I could not deal fully with your comments, anent my letter, in your last issue; and I now do so—a proceeding you await with "peculiar interest."

I could not refrain, however, from having a tilt at the following apparent absurdity contained in your comments: "It is a very sad confession of being 'behind the times' in the news of the gas industry when Mr. Brearley says that the first intimation," &c. If by this you mean that it is necessary that one should remember absolutely everything which it pleases you to record in your columns, then I at once plead guilty. One at times comes across matters, even in the "JOURNAL," which it is best to forget as quickly as possible; and I would place in this category a large portion of your acrimonious comments of Sept. 25—such personalities, for example, as "Mr. Brearley's mind must have been extraordinarily clouded," "he now criticizes phrases, muddles up meanings, acknowledges his ignorance," &c., &c.

You refer to your issue of Jan. 9 last, in which a paragraph appeared as follows: "The exhibition which it was proposed to hold in Edinburgh next year has now been postponed until 1908, in consequence of the strong representations made by the Dublin Exhibition Committee as to the injurious effect that would result from the holding of two exhibitions in the same year."

I absolutely fail to see what this paragraph has got to do with the matter, since there is no reference whatever to gas. It is true that in your issue of March 20 an article was inserted dealing with the International Exhibition at Dublin; and though a reference to a Gas Lighting Section is there included, it is sandwiched between references to other sections amounting in the aggregate to nineteen groups, with no indication whatever of the scope of the Gas Section.

It was not until your issue of May 29, that any prominence was given to the matter; and this was within three weeks of the meeting of the Institution of Gas Engineers. It was because I had some doubts on the matter, and had not time to look through the back numbers of the "JOURNAL," that I inserted the words "if the writer is correct" in my letter of Sept. 25. I was quite certain, however, that nothing had appeared as far back as February last.

It may interest you to know that my letter was read to our Exhibition Sub-Committee the day previous to your issue containing it. It was fully approved, as representing not merely my own views, but also the views of the Committee; and had time permitted it would have been sent not as my own production, but on behalf of the Committee.

On behalf of the Manchester Institution, I accept your statement that you "wish the Manchester Exhibition to be successful to the fullest extent that can be desired by the best-intentioned friends of the Manchester Institution;" and we look to you to keep that point of view steadily in front of you as the arrangements for both the exhibitions progress. Then I feel confident—in my "beautiful optimism"—that you will have to, as you hope, record complete success in both cases.

Longwood, Oct. 3, 1906. JNO. HY. BREARLEY.

Gas v. Electricity at St. Austell.

SIR,—The paragraph published in your issue of the 2nd inst. *re* the above is incorrect; and I should be glad if you would correct the same in your next issue. The facts of the case are as follows.

The present contract with the Gas Company terminating at Michaelmas, the Electric Light Company approached the Council, and sent in a tender for the public lighting of the town. The Directors of the Gas Company, who have at all times done their best to co-operate with the Council in their efforts to improve the lighting of the town, and not knowing that the Electric Light Company were tendering, were of the opinion that several economies might be effected before the new contract was made; and they suggested in a letter to the Council that, by abolishing the pilot-lights, and starting to extinguish at 11.30 instead of 12 o'clock (midnight), and by placing the lighting and extinguishing of the lamps under the control of the Company, very considerable economy might be effected.

The Council then decided to ask the Gas Company and the Electric Light Company to tender for the public lighting of the town. The lamps, 110 in number, which were to be of 60-candle power each (three lamps to be of 150-candle power), were to be lit from sunset to midnight all the year with the exception of the month of June. Six of the lamps were to be night lamps, and to be extinguished one hour before sunrise. The lighting and extinguishing was to be included in the price. The Gas Company tendered, as stated in your paragraph, at 35s. per lamp, and £1 per lamp extra for the three double burners. The Electric Light Company tendered at £1 5s. per lamp, with an additional charge of £14 a year for the switching on and off—making 27s. 6d. a lamp, or 7s. 6d. below the Gas Company's tender.

It will be very evident to readers of the "JOURNAL" that such a price is an absurd one commercially for the Electric Light Company to offer, as by using "Tantalum" lamps (the most efficient on the market) the cost per unit charged to the Council would be a slight fraction over 1d.—a price at which it is impossible for a small electric light undertaking to supply, except at a big loss. The average cost per unit of the whole of the works in the United Kingdom is 2·3d. The matter has been referred to the Lighting Committee, and should the Electric Light Company be given the contract, they will have to lay down several miles of cables to supply the public-lamps, as the district is a very scattered one.

The Gas Company of St. Austell have had competition with electricity since 1886; and during the last ten years, the undertaking has changed hands no less than three times. In 1903, the United Kingdom Tramway, Light Railway, and Electrical Undertakings, Limited, who had taken over the Company in 1900, closed the works down, as they could not be made to pay. The present Company (floated by the National Provincial Electricity Corporation, Limited) purchased the undertaking, and after the lapse of a year started supplying again on Dec. 16, 1904. But up to the present very little business seems to have been done, and for reasons best known to themselves they have made a bid for the public lighting at a price which I think no other electrical company in the country would look at.

The Gas Company, in their tender of 35s. per lamp, have quoted a price which is, for the hours lit, lower than any town in the West of England except Plymouth. They are not prepared to supply gas to the Urban Council at a big loss, at the expense of their other consumers in the town; and if their competitors choose to do this by putting in such an unremunerative price, they must do so.

I have written you somewhat at length, as from time to time in the past you have given an account of the competition with electricity in St. Austell, and some of your readers will, I think, be interested to know how our competitors do "business" in this part of the country.

St. Austell, Oct. 4, 1906. HAROLD E. RILEY, Engineer, Manager, and Secretary.

Encouraging the Use of Coke.

SIR,—The lighting and heating season is again with us, and various special "lines" in gas, in both branches, are being well displayed in your columns; yet, in my opinion, there is a lack of attention to another branch of equal importance to a large number of works, if not to all, that would pay well for similar reasonable attention—viz., the coke department. Considerable improvement in this department has, I believe, already been effected by various parties, which at times we have seen reported in the "JOURNAL"—noteworthy among them being Longwood, by Mr. Brearley. Even a city like Bradford is catering for this department with advantage with broken coke. I am alluding now more particularly to the domestic side of the subject, and not forgetting its undoubted benefits on the smoke abatement as well as the financial side of the question. True, we have the latest and most improved gas fires and stoves well represented; but these luxuries are not, and cannot be, available yet for the bulk of the working-class consumers, particularly in small places where the price is prohibitive.

I am far from wishing it to be understood that the larger works would not benefit by the course I suggest; but it is not attention to the better condition—in the broken state—of this commodity only that is needed, but further enlightenment of consumers on the best and most successful methods of its use. Where are the best and most suitable stoves to be obtained? What are the most effective simple modifications required to ordinary kitchen or room grates? This subject, if I remember rightly, received considerable attention some time back by the Smoke Abatement Society. Are their findings and suggestions ready? Cannot something be done to tabulate in circular form, for free distribution by gas undertakings, all known advantages and simple arrangements, both of new grates, stoves, and the best modifications for existing grates; for surely this, besides filling many other bills to advantage, should, in the keen competition with the electric and all other forms of light, prove of advantage to the whole gas industry.

Oct. 5, 1906. AN ANXIOUS ONE.

Cirencester Gas Company, Limited.—At the annual general meeting of this Company on the 29th ult., the Directors reported that the price of gas was reduced by 2d. per 1000 cubic feet as from Michaelmas last year; but, notwithstanding this, the profit was within £100 of that made in the twelve months ended June, 1905. The balance on the revenue account was £3001, which, after allowing for interest on the debentures and the interim dividend, was adequate to pay dividends for the half year at the rate of £12, £8 8s., and £6 per cent. on the several classes of shares, and also allowed of the placing of a further sum of £250 to the depreciation account and the writing off of £293 10s. against the sulphate of ammonia plant; leaving a balance of £218 16s. 4d. to be carried forward. The Directors added that the slot-meter system was growing in favour with the artizan class, and the maintenance by the Company of incandescent burners had proved satisfactory. The report was adopted.

A Defective Water Supply.—In consequence of complaints made to the Local Government Board respecting the failure of the water supply, Major Stewart, one of the Board's Inspectors, visited the village of Flushing, Cornwall, last Thursday, and held an inquiry. It was explained by the Rev. F. F. Savage, the Vicar of the parish, that a reservoir had been made, but that it was found to contain practically no water. The result was that a large number of the inhabitants were without water, except such as was carried from a distance. The cost of the works was to be repaid in 30 years; and a rate of 1s. in the pound was made for six months, being one-sixtieth of the cost. As the rate was levied for a water supply which they had not received, a large number of people had, under legal advice, declined to pay. Several other ratepayers joined in the complaint, and expressed the opinion that the scheme was a failure and a waste of money. The Clerk to the Rural District Council and the Sanitary Inspector said it was true that the supply was insufficient, and that the reservoir was empty. This was partly due to the dryness of the summer; but the Inspector thought that more water could be obtained by driving an adit. He suggested that the Council should call in an Engineer of experience; while the Clerk said that the Council would do what might be suggested by the Inspector to remedy any defect which exists.

MISCELLANEOUS NEWS.

NOTTINGHAM CORPORATION GAS UNDERTAKING.

The Recent Inquiry.

Our Nottingham correspondent writes: Following upon the discussion last week by the Nottingham City Council of the report of the Special Committee appointed to inquire into matters connected with the management of the Corporation gas undertaking, quite a flood of correspondence has been let loose locally. Whatever developments may occur in relation to the subject, the one thing already quite manifest is that the discussion is not likely to be allowed quietly to drop, as it was clear that some who took part in the debate at the recent Council meeting wished it might do. Under ordinary circumstances, such a quiet shelving of the matter might not have been difficult of accomplishment; but in view of the near approach of the municipal elections it has been rendered impossible. Several of the old members of the Council are seeking re-election, and there are some new aspirants for municipal honours whose openly expressed views indicate that the gas question will form one of the main topics in the impending campaign. The demand for the publication of the evidence adduced before the Investigation Committee is growing daily. It is pointed out that, after the somewhat acrimonious controversy of recent months, it is neither fair to the ratepayers nor just towards the Engineer that the matter should be allowed to be stifled. There has been no indisposition on the part of Mr. Brown to meet in the fullest manner possible the criticisms which have been levelled against the management of the undertaking so far as he is personally responsible. Some suggestions of the most extravagant character have been made by non-technical men, involving in a mass of hazy generalities the idea of the inefficiency of the control; and when the Committee presided over by Sir John Turney arrived, after exhaustive examination, at a conclusion which exculpates the Engineer, the peculiarity of the situation was accentuated by the resolute refusal to permit the publication of the testimony upon which the decision was based. It is certain, however, that there will be some awkward questions asked during the forthcoming contests, and probably in no quarter of the town will livelier interest be displayed in the matter than in Broxtowe Ward, which embraces the district in which the principal gas-works are located. One of the present representatives of the ward is Mr. E. Harlow, the late Chairman of the Gas Committee, who was re-elected last November, when his opponent in the Conservative interest was Mr. H. Spray. Mr. Harlow's term of office does not expire until November, 1908; but it is understood that, should he appear during the next few days in support of a colleague who is seeking re-election, the opportunity may be utilized for putting some pertinent questions in regard to points on which there is a not unnatural demand for further information.

ALLIANCE AND DUBLIN CONSUMERS' GAS COMPANY.

The Half-Yearly General Meeting of this Company was held on Saturday, the 29th ult., in the Company's Offices, D'Olier Street, Dublin—Alderman W. F. COTTON, D.L., J.P., in the chair.

The SECRETARY and MANAGER (Mr. Francis T. Cotton) having read the notice convening the meeting, the report and accounts for the six months ended the 30th of June were presented. They showed that the gross receipts amounted to £143,600, and the expenditure, including interest on the loan capital, &c., to £106,088; leaving a balance of £37,512. From this sum the Directors recommended the payment of dividends at the rate of 10½ and 7½ per cent. per annum on the respective shares, after which a sum of £1050 would remain to be carried to the next account. In the half year there was an increase of nearly 11 million cubic feet in the quantity of gas sold; but the market for residual products remained very depressed, as evidenced by the reduction of receipts under this head amounting to £4559.

The CHAIRMAN, in moving the adoption of the report, said the proprietors would no doubt remember that when they met in March last he was in the unhappy position of having to inform them that, in order to pay the usual dividends, the Directors found it necessary to draw on the reserve fund to the extent of £2840. Fortunately, he was now able to tell them that they could pay the usual dividends out of the half-year's profits as heretofore, and carry over a balance. They had written off £1000 from the suspense account, which he told them on the previous occasion would be formed to meet the expenditure on repairs and the reconstruction of one of the large gasholders. Notwithstanding the depression in trade, there had been an increase in the sale of gas of about 11 million cubic feet compared with the quantity sold during the corresponding period of last year. This increase was small; but they must bear in mind that they had a strong competitor in electric lighting, besides the great popularity of incandescent gas lighting, which had in a large degree curtailed the consumption. The great amount of light obtained by the use of incandescent mantles led to considerable economy of gas when compared with the consumption by ordinary flat-flame burners; and hence it was that, on the recommendation of the Directors, the officers of the Company had been doing all in their power to encourage their use, in order that the customers might be provided with gaslight on the most economical conditions. A large staff, whose services were given free by the Company, was employed for the purpose of attending to complaints of defective mantles or unsatisfactory lighting. There were a few items in the accounts to which he might be permitted to call attention. Under the head of "residual products," the markets for which had been very depressed, there was a falling off of £4559 in receipts. The Company were not singular in this respect, for he found that nearly all the companies and local authorities in the kingdom who were suppliers of gas had suffered to some extent from the same cause. This state of things usually occurred through depression in trade, when the demand was not equal to the supply. On reference to the debit side of the balance-sheet, and comparing the cost of working with the corresponding period of last year, it would be found that there were considerable reductions, for which he thought the Directors and officers might claim credit for economy. This was not the result of increase in business nor augmented consumption of gas. It arose from the care which had been exercised in the purchase of all materials used in manufacture, in wages paid, and in savings effected in nearly every department. In coal and oil there had been a saving of £1357, notwithstanding the increased quantity of gas made and sold; in purifying materials, of £234; in wear and tear of works and distribution plant, £1506; in bad debts, general charges, and law costs, of £793, in addition to several smaller reductions, amounting in all to upwards of £5000. The automatic meter business continued to improve. During the six months under review, 2103 new installations had been brought into operation; and in most of these cases provision was made for two or three lights, in addition to a gas cooking-stove. During the same period, there were installed 2718 slot cookers, 528 hired cookers, and 75 heating-stoves. He was glad to say the public were beginning to understand the great advantage arising from cooking by gas, especially during the summer months. He might mention that during the hot weather the demand for gas-cookers in London was such that it was difficult to overtake. At the last meeting, the proprietors were informed that the Directors, in accordance with the powers vested in them, had disposed of £50,000 of share capital by auction, under the provisions of the Company's Acts. The dividend payable on the additional capital, taken at the present rate, would amount to £3750 per annum. A portion of this sum was included in the accounts submitted. He felt confident the proprietors would concur in saying that, on the whole, the balance-sheet was a source of gratification; and, so far as business knowledge and experience could guide the Directors to a conclusion, they believed that the prospects for the future were encouraging. The contracts for coal and oil, at reasonable prices, had nearly two years to run; and they had no doubt that the residual products would realize better figures with an improved market.

Mr. JOHN MURPHY seconded the motion; and it was carried.

The dividends recommended having been declared, a vote of thanks was accorded to the Chairman and Directors of the Company, and also to the officers.

The CHAIRMAN and Mr. F. T. COTTON returned thanks; and the proceedings terminated.

ABERGAVENNY CORPORATION GAS UNDERTAKING.

Resignation of the Manager.

At the Monthly Meeting of the Abergavenny Town Council on Monday last week, the Gas Committee reported that a number of replies had been received from Chartered Accountants, with their terms, for investigating the accounts of the gas undertaking and preparing a proper revenue account and balance-sheet for the year ending the 31st of March; and that they had accepted the offer of Mr. H. Leicester, of Worcester, subject to his being able to commence work on the 24th or 25th of September. The matter, it may be remembered, was before the Council at a meeting on the 27th of August, as mentioned in the "JOURNAL" the following Tuesday. Mr. Leicester made his report, and it was submitted to the Council. He stated that the trading or revenue account for the year ended the 31st March last, as submitted for his examination, showed a loss of £491 14s. 6d. It was, however, discovered that the debts due at the corresponding date of the previous year for coal and expenses had not been taken into account against the trade for that year, but that all these sums had been charged to the 1906 account, in addition to the amounts owing at the 31st of March last. This item for liabilities was also omitted from the 1905 balance-sheet; and the course adopted for some years of ignoring the liabilities made it impossible to take the annual accounts of the expenses as accurate. The sum thus improperly charged to the 1906 trading amounted to £843. Some further items chargeable to 1906 were, however, discovered, amounting to £15. After crediting the 1906 account with the £843, and charging it with the £15, there was disclosed a profit of £336 6s. 3d. [A corrected revenue account accompanyied the report.] Mr. Leicester said the Committee would wish to know why the profit of £336 for 1906 was so small, compared with previous years; and he then proceeded to enlighten them on the matter by making a comparison with the year ending March, 1900. He showed that the total expenses in the latter year were £131 9s. per million cubic feet, as against £157 13s. in the last financial year. The two principal items calling for comment were coal and repairs. Working out the cost per ton of coal showed 1900 to have been 11s. and 1906 14s. 7d.—an extraordinary advance which had only increased the yield of gas per ton by 900 cubic feet. As to the repairs, it should be noted that a sum of £420 7s. 1d. had been spent in 1906 upon repairs to meters and stores, mains, and services; while in 1900 nothing had been spent under these headings. Mr. Leicester said it was a great surprise to see a sum of £629 13s. 9d. in the hands of the collector at the end of the year; and the Committee could not be too strongly urged to require a more regular and punctual paying over to the Treasurer of all sums collected. The leakage for the year was shown at over 5 million cubic feet. This was an extraordinary amount; but it might be partly accounted for by the meters having been taken some time after the close of the March quarter in 1905.

In moving the adoption of the Gas Committee's report, Mr. Deverall, the Chairman, said that, after considering the details so concisely set out by Mr. Leicester, the conclusion they had come to was that they had not sufficient confidence in the Manager to seek to retain him; and they recommended that, unless he placed his immediate resignation in the hands of the Council, he be paid a month's salary, and his appointment terminated forthwith. At a subsequent stage of the proceedings, the Town Clerk read a letter from Mr. Russell stating that, having regard to the policy which certain members of the Council had seen fit to adopt, and which was, in his judgment, inimical to the welfare of the undertaking, and prevented his continuing to discharge his duties with satisfaction to either the ratepayers or himself, he begged to give the Corporation twelve months' notice of his intention to terminate his engagement, to expire on Oct. 14, 1907. The report was adopted.

FINANCES OF THE MANCHESTER GAS DEPARTMENT.

Mr. Charles Nickson, the Superintendent of the Gas Department of the Manchester Corporation, has presented to the Gas Committee a statement prepared by Mr. F. A. Price, the Deputy-Superintendent, showing the financial history of the gas undertaking from April 1, 1894, to March 31 last—a period of twelve years. The object of the compilation is to provide evidence for the Local Government Board Inspector, who will shortly visit Manchester to inquire into the application of the Gas Committee for sanction to borrow money for the construction of a larger gasholder than has hitherto been built in the city. The period covered happens to be that during which Alderman Gibson has been Chairman of the Committee. The total number of consumers in 1895 was 82,289, of whom 1481 were on the prepayment system. In the year just closed, there were 160,113 consumers, of whom 52,006 were by prepayment. The number of cooking-stoves has increased from 3379 to 29,760; the use of these appliances having gone up by leaps and bounds since stove hire, like meter-rents, was abolished.

The gross profits have fluctuated between £134,697 in 1895, and £135,433 in the year ended in March last. The highest figure reached was £224,821. Of the net profits of £1,263,539 realized in the twelve years, £409,678 has been paid to the sinking fund, £631,182 to the city fund for the relief of the rates (of which £59,283 was so paid last year, £60,000 in 1905, and £70,000 in 1894), and £170,638 applied to the extension of works, where borrowing powers have not been granted, and other purposes. The amount paid in 1906 under this head was £69,892, of which £50,710 was paid for the purchase of the property, rights, and privileges of the Stretford Gas Company in Chorlton-cum-Hardy.

The net outlay on extension of works and plant amounted to £1,033,997 in the twelve years; and the sum charged against revenue in respect of renewal of plant was £399,354. The property and assets of the department are valued at £2,866,694—or an increase of £1,059,216. The total amount of liabilities, including mortgage debt, stands at £1,393,145, being an increase of £463,796, and the excess of assets over liabilities is £1,473,549, or an increase of £595,420, as compared with the figures for 1895. The price of gas has varied in the twelve years, and is now 2s. 3d. per 1000 cubic feet in the city, which is lower than at any period from 1901 until the first quarter of last year. The price to consumers outside the city is 3d. per 1000 cubic feet more than is charged in the city.

FATAL GAS POISONING IN LIVERPOOL.

Last Friday morning, information was received by the Liverpool police of a case of suffocation by gas on the premises of Mrs. A. Tollet, a watchmaker, in Williamson Street. Shortly before nine o'clock, she detected a strong smell of gas, which seemed to come from one of the back bedrooms. She opened the door and found the room full of gas; the tap being turned on and the window closed. She raised an alarm, and called a policeman. The occupants of the room were carried out, and were all found to be overcome by gas. Medical aid was rapidly forthcoming, while additional police officers were soon on the spot. The occupants of the room were William Barton, a man of 38, William Tollet, aged 10, Arthur Tollet, aged 8, and Richard Grogan, aged 4 years. Barton had unfortunately succumbed. William Tollet was taken into the open air and artificial respiration was at once resorted to. It was effectual; but his condition was very grave. Arthur Tollet was conveyed to the Northern Hospital in a critical state. The child Grogan, however, revived rapidly under the attentions of the assistants. The affair was confined to the occupants of the one bedroom, the others, six in number, not being affected. How the gas escape was caused is not clearly known. It is surmised that someone in the room turned on the gas by accident during the night.

THE FATAL GAS EXPLOSION NEAR HOLBORN.

Verdict of "Death by Misadventure."

Last Tuesday, Mr. WALTER SCHRODER, the Deputy-Coroner for Central Middlesex, held an adjourned inquest at the Municipal Buildings, Holborn, on the body of Harry Tansley (34), an employee of the Gaslight and Coke Company, who was killed at a gas explosion which took place on the premises of Messrs. H. & G. May, of May's Yard, Eagle Street, Holborn, on the 30th July last, as recorded in the "JOURNAL" next day.

Mr. BODKIN (instructed by Messrs. Monier-Williams and Robinson) represented the Gas Company; Mr. WOODCOCK (instructed by Mr. Charles May) appeared for the owner of the premises.

The CORONER having read over to the Jury his notes of the evidence taken on the previous occasion,

Frederick Nunn, a labourer, in the employment of the Gas Company, was called, and deposed that he was one of the workmen engaged with the deceased repairing a pipe in May's Yard previous to the explosion. A trench was opened about 15 inches deep, when a broken bend of gas-pipe was discovered (the end of which was stuffed with rag and white lead), and afterwards a new pipe put in. It was while they were engaged in filling in the trench that the explosion occurred. He saw in front of him a flash of light, which was followed by a report. He was quite positive no match was struck by either him or his mates, and none of them were or had been smoking.

Examined by Mr. BODKIN, witness said the pipe in question was a 1-inch wrought-iron pipe of the description generally used for services. The fractured pipe seemed to be in a perfectly good condition, having no signs of decay about it. The ground above the pipe was the ordinary soil, on the top of which were cobble stones. A sudden break of a pipe of this kind would mean that it had received a serious wrench. The pipe would remain uncapped some two or three minutes while the new length was being screwed on. The earth that was excavated smelt of gas, which was consistent with there having been a leakage into it for some 24 hours. No one drew his attention to the existence of the cellar-flap in the yard.

In answer to Mr. WOODCOCK, witness said he did not hear his mate Petch draw the attention of Hobson (Messrs. May's yard foreman) to the cellar-flap. It was not their practice to test a joint after they had made it. When they did test, it would be done by fire; but it was not done on this occasion.

Henry Petch, the other workman, who was also injured, was brought up from the hospital, and deposed that the pipe, with the exception of the fracture, was in a fairly good condition. He could not form any opinion as to the cause of the breakage. At the time of the explosion, he had a hammer in his hand, and was packing under the pipe.

Replying to questions by Mr. WOODCOCK, witness said the work was carried out carefully and properly. Except when the temporary plug was taken out for the iron cap to be fitted, and when the cap was taken off to make the permanent joint, there was no escape of gas from the pipe. It was their practice, when there was an escape underground, to ask whether there were any cellars; but in a stable yard they should not think of doing so. He was quite clear that none of the men were smoking at the time. During progress of the job, a workman came from another job to borrow some tools, but he was not smoking.

Thomas Ridsdale, the porter at Halsey House, Red Lion Square, stated that on the afternoon in question he was going to examine the cistern; and on looking down into the yard from the landing on the fifth storey, he saw some men working, and noticed that one man was smoking. He could see that the tobacco was burning. This was some 20 minutes before the accident. He recognized one of the men in the room.

Charles Howell (the man referred to) was called, and deposed that he was a fitter in the employ of the Gas Company, but denied that he was on the scene of the accident at the time stated by the last witness.

William Hobson, who gave evidence on the previous occasion, was recalled, and said he did not notice any other men come to the yard while the work was being carried out, and did not see anybody smoking. He should not think it was a common thing for any of the men working with him to tie the horses up to the gas-pipe, and he had never known such a thing to have been done.

Alfred Shadwell and *John Negus*, workmen in the employ of the Gas Company, deposed that they were in May's Yard while the work was going on, but neither of them was smoking.

Mr. *H. May*, the lessee of the wrecked yard, was next called. He said the first time he detected a smell of gas was on the Sunday morning previous to the explosion, on which day he saw one of the horses tethered to the gas-pipe against the wall. When the horse moved, the pipe was pulled from the wall. After this there was a faint odour of gas. He had the pipe knocked back to the wall with nails by one of his own men. This occurred about half-past ten in the morning. He thought at the time that this might possibly be the cause of the leakage, though he was not certain. He communicated with the Gas Company by telephone about three minutes after eight o'clock, as soon as he thought there would be anybody at the office. In response to his communication, a man came who said he would go back and make a report. The Company evidently did not think it was very serious, because five hours elapsed before anyone came to repair the pipe.

By Mr. WOODCOCK: This was the first time he had said anything about a horse pulling the pipe away from the wall. He had never been called before.

Mr. *G. F. L. Foulger*, the Chief Distributing Engineer of the Gas Company, said he first heard of the accident about half-past five on the same day, and immediately proceeded to the spot. He was of opinion that the work had been carried out in a proper way, in accordance with the Company's regulations. It would not be necessary to make any test, because with such a small pipe, screwed up in the way the one in question was, it would be unlikely that any escape would be found. There had been no suggestion that the explosion was caused by any defect in the joint made by their men. With regard to the three men employed on the work, he had no reason to believe that they were not careful. The Company were most particular with their workmen, recognizing as they did that they were dealing with a dangerous commodity. The slightest relaxation of their duty, or any tendency to drink, would be met with instant dismissal. There were most stringent regulations in force with regard to smoking, the infringement of which would lead to a severe caution in the first instance, to be followed by dismissal on a subsequent occasion. During the whole time he had been the Distributing Engineer, he had not known of more than three cases where men had been detected smoking on a job of this sort, and that was over a period of eighteen years, dealing with as many as 1500 men of their own, and probably another 1500 employed by contractors under the Company. He had formed an opinion as to the cause of the explosion; and it was this: During the Sunday, the gas, in addition to making its presence known in the open, was percolating into the vault under the stables. He was also of opinion that the quantity of gas which had obtained access to the vault had reached the most explosive point. When unmixed with the atmosphere, gas was not explosive; but commenced to be so when the mixture reached the proportion of $7\frac{1}{2}$ per cent. of gas. It increased in violence up to 10 per cent., at which point it was most explosive. It was also explosive till it reached 15 per cent., at which point the mixture would burn, but with a blue flame. At the most explosive point—viz., 10 per cent.—the flash would be so instantaneous that fire never followed from it. It would not set fire to such delicate fabrics as lace curtains nor even blister furniture. It was a perfectly clear explosion, and was as instantaneous in its action as would be dynamite. The greater the mixture became, the more would the violence of the explosion be reduced, and the more would the flame be increased. Having regard to this, and to the fact that no fire followed on the occasion in question, he was of opinion that the most highly explosive mixture had formed.

Questioned by the CORONER as to how he accounted for the explosion on the evidence that had been given, witness said it appeared that the deceased, when discovered, had an iron rammer in his hand. From

this it was clear to his mind that the man was in the act of ramming a portion of the trench, in order to consolidate it so as to admit of the cobbles being reinstated. In his opinion, in ramming the ground the man struck a flint, which threw off a minute flame. The reason why he said a "flame" was because a flint would throw off one; a spark not being sufficient to ignite gas. A spark would ignite gunpowder, but not gas; and it was well known that, in striking a flint with iron or steel, one got an actual flame, as was proved by the fact that before matches were invented this was the common way of lighting candles. Having started that minute flame, he was of opinion that there was a train of gas—not at the explosive point, but between this and the 15 per cent. which would enable combustion to go on through the loose ground—and that the flame went along the course of the channel which the escaping gas primarily followed into the vault. It would flash back like a train of gunpowder into the vault itself, which undoubtedly contained a mixture that he estimated to be explosive to the highest possible degree. This was his explanation of the cause of the firing of the gas on the occasion in question. The extent of flame which would be necessary would be very minute—in fact, it would be hardly discernible. The difference between a spark and such a flame as that to which he had referred could only be detected by an expert; and even then he thought it would have to be tried by a laboratory experiment with an explosive mixture.

By Mr. BODKIN: Greater heat was given off by such a flame than by a spark. It would be very difficult to measure the calorific power of such a flame. The engineers of his department were on duty day and night. The office was never closed, not even on Sundays and Bank Holidays.

By Mr. WOODCOCK: The chances of any danger from an escape of gas would be vastly different in an open yard from what they would be in a closed place. To an ordinary person not conversant with these matters, so slight a smell as that referred to by Mr. May would not indicate that there was any danger.

William Allen, the Superintendent of the "A" Division of the London Salvage Corps, stationed at Shaftesbury Avenue, said he was called to the scene of the accident at 3.30 o'clock in the afternoon. There was no fire; and all he did was to assist in recovering the injured men.

Mr. *W. H. Hewish*, an architect and surveyor, deposed that the size of the vault in question was 30 feet by 16 feet. He could not say what was its depth; but he remembered that he could stand up in it.

Mr. *Foulger*, recalled, said that, taking the dimensions of the vault as given by the last witness, he should estimate that there would be 40 cubic feet of gas in it.

This being all the evidence,

The CORONER reviewed the facts of the case to the Jury, who, after a short interval, returned a verdict that the deceased's death was due to shock from fracture of the spinal column caused by an explosion of gas at May's Yard; and expressed the opinion that this was caused by the gas present in the vault, and that the deceased met his death by misadventure.

GAS v. ELECTRICITY AT HANLEY.

The Hanley Town Council, at their usual meeting last Tuesday week, discussed at length the relative merits of gas and electricity for street lighting.

In their minutes, the Electric Lighting Committee stated that they had considered what steps should be taken in connection with electric street lighting to further improve the same and reduce the cost. It was pointed out that a reduction had been made in the last eighteen months in the price charged for private lighting and motive power; that it was not correct to say that more efficient lighting could be obtained by gas than by any system of electricity supply at present in use; that as the supply of electricity increased, and as economies were effected by the introduction of new plant, &c., at the electricity works, the electric light could be increased in amount and supplied without loss at a considerable reduction upon the present cost; and that the cost depended to a large extent upon the number of lamps supplied and upon the cost of the mains, and that many streets were at present provided with mains which were not fully utilized, but upon which the full amount of interest and sinking fund had to be paid annually. The addition of a number of street-lamps along roads already provided with mains would be of great advantage to the street lighting; and this could easily be done, owing to the economies effected in the past year at the works, without any loss to the department. For example, in streets not effectively lighted at present, it was suggested that an increase in the number of lamps should take place without extra cost to the lighting of such streets. The Committee recommended (1) that the lighting of streets in which electricity mains have been laid be carried out by electricity, and that no extra charge be made for the increased number of such lamps beyond the sum already received by the Electricity Department until the average price per post falls to £2 13s. 4d., which price is charged by the Gas Company for a 5 cubic feet batswing burner; and (2) that the Works Committee be recommended to double the number of lamps in Etruria Road and Lord Street, Etruria, in which case the Committee would light and maintain them without increasing the charge made for the lighting of these streets.

Alderman Coates (the Chairman of the Electric Lighting Committee), in moving the confirmation of the minutes, said they were very anxious to light with electricity as many of the town's streets as possible; and they suggested that lamps should be put up on all the existing mains, wherever they ran. They proposed to charge no more to the town for the increased number of such lamps, until the price was brought done to £2 13s. 4d., the price charged by the British Gaslight Company for a 5 cubic feet batswing burner, so that the town would benefit by the alteration. The Committee were anxious that tradesmen should use more arc lamps, and had made a quotation of £5 per lamp per annum, whatever the consumption of the lamp might be.

Mr. Schofield seconded the motion; remarking that they had sold in the first six months of this year 230,000 units more than they did in 1899, with a consumption of 800 tons of slack less.

Mr. Stanley quoted places where electricity had been supplanted by gas for street lighting, and pointed out that the Gas Company had made the Corporation an offer the result of which would have been to give them, for about 30 per cent. less cost, at least double the amount of light they at present had. Mr. Yeaman, the Borough Electrical Engineer, proposed to give them an increase in the number of lamps without any increased cost for the lighting of the street. What did this imply? It implied that he recognized he was charging too much at present, otherwise he would not be ready to make this change. Mr. Yeaman said he would supply them without extra charge until the average price per post fell to £2 13s. 4d., which price was charged by the Gas Company for a 5-feet batswing burner. But as a matter of fact, the Gas Company did not propose to give them a burner of this kind; they proposed to give an incandescent burner, which was quite a different matter. He estimated that if they had accepted the Gas Company's offer, there would have been a saving of at least £875 a year to the town. He thought they ought to have a report; and he moved, as an amendment—"That a report be made by the Electric Lighting Committee of the Council on the relative cost and efficiency of lighting by gas and lighting by electricity in the town."

Several members expressed themselves as being in favour of such a report; and then Mr. Yeaman, at the request of the Council, made a statement. He said that when he went to Hanley he was surprised at the condition of the side-street electric lighting. There had been an improvement, however; and he suggested that they could go on giving increased illumination until they got as good a light as, and later on a better light than, they could obtain in any other way. The town owned its own works, and could afford to produce electricity for long-hour consumption at the price at which people were supplied with motive power—1d. per unit. They had spent their capital, and could never get it back. Every improvement they made would reduce the cost of the light; and every increase of light would have the dual effect of augmenting the consumption of electricity while reducing the cost per unit. The reduction of the total consumption by changing the street lighting would in nowise assist the undertaking in keeping down its capital. There were in view some 200 additional kilowatts of motive power, which would most probably be connected to the mains before the end of the current year, and new plant was required, whether the street lighting was continued or not. The street lighting could eventually be done for practically nothing, when there was a big undertaking. As to the instances of electricity being supplanted by gas which had been cited, anybody having, as he had had, ten years' experience in London, would know that the lighting discarded was lighting put up many years ago, and had remained unaltered since. In Hanley, they were in the same condition to-day. The pendulum was going towards gas lighting at the present time, but it would surely swing back when flame lamps were more generally introduced. He had made a tour of Burslem and Stoke; and he could not see that the lighting there, by incandescent gas, was any better than the light Hanley could give. If an undertaking was to be run to the best advantage, street lighting, properly done, was the most excellent advertisement it could possibly have. Street lighting could be done more cheaply than any other lighting, because of the long period for which the light was required. The trouble with electricity was the capital charges involved. The capital cost of mains, &c., was the same whether the lamps were run for 600 hours a year or for 4000 hours. In answer to a question, Mr. Yeaman said that, assuming they had the whole of the street lighting of Hanley, the Electricity Committee would eventually be able to do it at a considerably less cost than by gas.

Alderman Coates remarked that all his Committee had done was to remind the Works Committee that the Electric Lighting Committee were prepared to light up by electricity the places where their mains were already laid. The Works Committee could please themselves whether they took up the matter or not. The Electric Lighting Committee said that, having spent £100,000, they were prepared to light the town streets on their line of mains until the price came down to exactly the charge made by the Gas Company.

Eventually, the words "in such cases as the Works Committee so decide" were added to one of the resolutions, which made its carrying out of a permissive character; and, as thus altered, the recommendations were carried—the amendment being lost.

GAS v. ELECTRICITY AS ILLUMINANTS.

Views of Mr. Jacques Abady.

In previous issues of the "JOURNAL," reference has been made to the correspondence on the above subject which has appeared in the Engineering Supplement to "The Times." A contribution to the discussion was made by Mr. Jacques Abady, who is well known to many of our readers; and it was published last Wednesday.

Mr. Abady commenced by expressing a fear that in the course of the discussion many issues had been raised which, though all pertinent in their way, required to be collated and brought to a definite conclusion if any useful purpose was to be served. He then pointed out that the questions to be decided are these: (1) Is gas or electricity better, cheaper, and more effective and practicable for public street lighting? (2) Are there any factors which stand in the way of pure competition between the rival illuminants on their merits alone? (3) Is it possible to find a universal method of photometrical expression for light values, of use (*a*) in comparing actual values of different light sources, and (*b*) in comparing street lighting efficiency? Having stated the points to be discussed, he proceeded to consider them separately as "a purely disinterested bystander."

As to the first question, I am afraid even the strongest partisan could not hazard a definite reply. There are so many factors governing the choice of the rival methods that one can only touch upon a few salient points. To begin with, the selection depends upon the general design of the town. If it be a town of broad thoroughfares, large buildings, spacious squares,

avenues, and promenades, then no doubt only large-unit lighting will satisfy the æsthetic tastes of the burgesses; and the choice depends upon cost and other considerations which I shall presently mention. If, however, an account of the structural characteristics of the town would amount to a tale of mean streets, then there is no question that (other considerations apart) incandescent gas lighting is far more suitable; for the only practical alternative of small-unit lighting would be filament lamps, and these everyone sorrowfully admits are both inefficient and ineffective. So it comes to this, that for small-unit lighting gas, with its very efficient mantle, easily beats electricity with its very inefficient filament. But when one comes to large-unit lighting, then the battle is between high-power gas-lamps and electric arc lighting: and the efficiency *per se* of the best types of these is very much on the same plane. As an example of what I mean, it must be understood that to get 1000-candle power for one hour with a filament lamp, it will take, on a generous estimate, at least 3500 watts; while the same light with a gas-mantle only takes about 70 cubic feet. On the other hand, comparing the most efficient forms of high-power lighting, to get 1000-candle power for one hour with a flame arc takes about 300 watts, while the same light with a high-power self-contained gas-lamp takes about 30 cubic feet. These figures are given with every confidence, because they are all based upon "mean hemispherical intensity," and are all easily demonstrable.

As to other factors of cost, if on the one hand there is practically automatic lighting, there are also heavy carbon and labour in renewing carbon costs; on the other hand, if the mantle renewals are a comparatively small item, there is still point to point lighting cost to be considered. Now, given practically equal costs and efficiencies, what of other determining factors, and what about rival charges? I say, first, that if a municipality is unfortunate enough to be saddled with a corporate gas or electric undertaking, then, even if it costs more, it is to a great extent a justifiable policy to utilize the municipal lighting, if it helps the manufacturing load; and from this point of view I can quite see the reasonableness of Marylebone in using this undertaking. The other aspects of the question I deal with under my second head. As to rival charges, even though a gas or electric company or public authority quotes a lower price, candle for candle, than its rival, it is a bad policy on public grounds to accept that low estimate if it cannot be carried out except at a loss to the body giving the estimate. If you are a branch of a public authority and you sell for 6d. what has cost you 1s. to produce, you are robbing your ratepayers; and if you are a company, you are robbing your shareholders. Such competition is distinctly illegitimate and harmful.

As to the second question, I think there are several factors which stand in the way of fair competition. The first is ignorance, the second is influence, the third is the second in another form—municipal trading. As to ignorance, I should perhaps say indifference, for it is difficult to imagine such ignorance on the part of a local authority as to specify the practical impossibility that "all lamps shall give a light of x candles as tested by our photometer." There is not a lamp made that fills this neat and simple little condition, and not a local authority that could go into a Court of Law and enforce it. As a matter of fact, the science of properly-distributed lighting has been altogether neglected; and the class of men who know less about it than others are the surveyors. Why should a surveyor trouble about this, when he knows that the local municipal light undertaking (gas or electric) will impose what lights the engineer thinks fit? As to influence, it is a fact that gas directors have influence in local bodies, that electric directors have also, and that local authorities, being interested parties in many cases, do not look to the public good, but to more or less remote private benefit. But this is an aspect of public life not confined to the narrow department we are considering. It is an aspect to make every public-spirited man pessimistic; for it is a fact that very few large public contracts are carried through on their merits, and the remedy remains to be discovered. As to municipal trading, here we branch from a discussion of hard facts to a question of opinion; and I can only state my own opinion, with great deference, that the public ownership of such enterprises as gas or electric manufacture is harmful and retrograde—harmful because leading to financial abuse, and retrograde because stopping fair and open competition.

Finally, dealing with my third question, in my opinion it is possible and easy to find a universal method of comparing the values of light sources; and it is possible and practical to photometrically express the practical value of street lighting. The proper method of comparing the practical efficiency of lights is to state the "mean hemispherical intensity" and the amount of energy required to produce it. I do not like to add to this long communication by attempting to explain this expression, and how it is arrived at; but the adoption of this method by manufacturers, and the insistence upon its adoption on the part of buyers, would stop the wild—I would almost say fraudulent—statements constantly made by interested parties. The law draws a sharp distinction between "trade puff" and "false inducements." There would be neither if the method stated above were adopted. As to the relation of the photometer to street lighting, Sir George Livesey is mistaken in saying that "such tests only indicate the power of individual points of light;" on the contrary, a street photometer tells actually the illuminating effect on any spot on the ground surface, and its intelligent use would encourage the study and consideration of reflection from buildings, character of pavements, equal distribution of light, avoidance of shadows, and would most certainly enable a standard minimum of street illumination to be established as a definite physical fact. The encouragement which would be afforded to invention by the establishment of such a standard is inconceivable; and the manufacturer would be able to produce scientific sources of light instead of (as he is now compelled) being forced to cater for the prejudice of the "man in the street" and the local councillor who likes to see a flare of light on the top of a badly-designed column.

Dartmouth Water Supply.—Two sittings of the Dartmouth Town Council last week were devoted almost entirely to the discussion of the question of improving the water supply. It was reported by the Water Inspector that the springs from which the water is derived were still very low, and that at the higher levels he had great difficulty in supplying the houses, some of which were within 20 feet of the reservoir levels. This information was supplemented by a statement made in course of the debate by Alderman Wilton, to the effect that 50 per cent. of the inhabitants had been short of water during the summer, while from 80 to 90 per cent. had been seriously inconvenienced. There were houses, said Alderman Wilton, where for weeks past there had not been a drop of water for drinking purposes, much less for cleaning and sanitary requirements. A report was presented by the Water Committee, recommending that an additional supply be obtained from the Old Mill on the Raleigh Estate, and that an agreement be entered into under which the Corporation would acquire rights over 180 acres of land on payment of £150 per annum, rising to £250. This water it was proposed to pump to the existing reservoirs. After a good deal of discussion, the report was approved.

BIRKENHEAD WATER SUPPLY.

The Welsh Scheme Adopted.

The Birkenhead Town Council held a Special Meeting yesterday week, for consideration of the recommendation of the Gas and Water Committee that the necessary steps should be taken for securing a water supply from Wales. This course was, it will be called to mind, decided upon by the Committee in consequence of the breakdown of negotiations between Liverpool and Birkenhead for a permanent supply to the latter of water from Vyrnwy. After having the matter placed fully before them, the Council agreed to proceed with the Welsh scheme, authority to carry out which will be sought for in the next session of Parliament.

Alderman Bloor, the Chairman of the Gas and Water Committee, in his statement to the Council, gave full details of the proposal [which was noticed at length in the JOURNAL for June 12 last], and explained that Mr. G. F. Deacon would be appointed Engineer-in-Chief at an exclusive fee of £20,000. Mr. Bloor said he thought the time would come when Liverpool would regret having failed to take advantage of the opportunity of associating Birkenhead with herself in the supply of water. The suggestion made by Liverpool that Birkenhead should buy her surplus water, the water for which she had no possible use, and for just such a time as it would be convenient to Liverpool to sell it, and at a price which pleased Liverpool, might suit Liverpool, but it would not suit Birkenhead. There were two fatal objections to the proposal. It would necessitate the abandonment of their own scheme, upon which so much pains had been expended, and at the same time it would leave them with the problem still before them of providing the town with an independent supply some time or other—a time which would be chosen by Liverpool, and not by them. At some time when Liverpool discovered that it was no longer possible to supply Birkenhead with water, she would give them notice. That might be at a most inconvenient time for them, most difficult, and most costly; and it might be impossible to then find a scheme which suited their requirements.

TORQUAY CORPORATION WATER SUPPLY.

The New Reservoir.

Mr. A. G. Malet held an inquiry at Torquay last Tuesday respecting an application by the Town Council for power to borrow £14,400 for the completion of the new storage reservoir at Trenchford, on the borders of Dartmoor, and £675 for the extension of mains in the Newton Abbot district.

The Town Clerk (Mr. F. S. Hex) made a statement with regard to the Corporation's indebtedness on the water-works, and said that £179,503 was owing on account of the water undertaking. With reference to this third application for money for the construction of the reservoir, the fact was that greater difficulty had been experienced than was anticipated in making the trench. The extra excavations had amounted to about 1400 yards, and the cost had been 13s. 7·1d. per yard instead of 10s. The Water Engineer (Mr. S. C. Chapman) said the excavation was now completed so far as the sill of the dam was concerned; but there was still some work to be done in connection with the overflow. The average depth of the excavation had been 40 feet, and the maximum depth 111 feet. Since the last inquiry, in August, 1905, the average depth had been increased by about 3 feet. Mr. Chapman also explained the difficulties they experienced in obtaining filling, and the cost which had been incurred in the repair of roads. Mr. C. R. Strachan, M.Inst.C.E., the Consulting Engineer, also gave evidence in support of the application, and said that, in spite of the difficulties encountered, all the work had been done in a satisfactory manner, and the money had been properly spent. In reply to the Inspector, Mr. Chapman said the question of the supply during the past summer had been one which caused him much anxiety. From March 21 to September 1, the rainfall was only 10·03 inches, against a mean rainfall of 21 inches in that period. The daily consumption was about 1,800,000 gallons; and the quantity of water in the reservoirs was equal to only about 18 days' supply. The Town Clerk said the past summer had demonstrated the wisdom of the Corporation in proceeding with the construction of the reservoir. The total amount they had expended upon it up to Sept. 30 was £44,303, which was £1600 in excess of the loans actually authorized.

Reference to the progress which is now being made with the construction of the reservoir was also made on the same day at the meeting of the Town Council. Mr. F. J. Croker, the Chairman of the Water Committee, said the work was going on very satisfactorily, and it was hoped that it would be completed next spring.

WINDSOR CORPORATION WATER-WORKS.

On Saturday, the 29th ult., a Meeting of the Association of Municipal and County Engineers, arranged by the Home Counties district, was held in the Guildhall, Windsor—Mr. J. PATTEN BARBER (Islington), the President, in the chair. In the course of the proceedings, Mr. C. SAINTY, the Corporation Water-Works Engineer, gave a short description of the works, from which we take the following particulars.

The works were purchased by the Windsor Corporation from the Windsor and Eton Water-Works Company in the year 1888, after a long and tedious arbitration; the authorized capital being £194,780, of which sum £160,000 was paid over, including the fees and costs. At that time there was the present water-wheel, which was in existence in the year 1830, and two of Mr. Cutler's (the original proprietor of the works) balanced outward-flow turbines, each working two 9-inch pumps with a 2-feet stroke. These two turbines were erected in 1873. There was also a small steam-engine, of the old grasshopper type, working a

set of 7½-inch three-throw pumps with 12-inch stroke, and an old-fashioned horizontal steam-engine driving a set of 12-inch three-throw pumps with a 20-inch stroke, and two old Cornish boilers. After a very short time, the steam-boilers were condemned by the Boiler Insurance Company, and they, and also the two engines named, were sold as scrap iron.

In March, 1891, when Mr. Sainty entered upon his duties, he found the water-wheel in a very bad state, so that it cost over £100 to repair. The Cornish boilers were taken out, and a new loco-type one put in. There were also two new turbines just set on their beds, and the pumps for them were ready to be erected. These were put in and started in November of that year, and also a compound condensing Worthington engine, made by Messrs. James Simpson and Co.; their capacity being 400,000 gallons in 24 hours against a 250-feet head.

In 1899, a new steel Cornish boiler, 18 feet long by 5 ft. 6 in. diameter, was supplied and fixed by Messrs. Taylor and Sons, of Marsden; also a new compound duplex 12¾ in. and 19 in. by 12 in. by 12 in. pumping-engine was supplied and erected by Messrs. Hayward, Tyler, and Co., of London. This engine ran in 1903 for three months day and night without a stop, and pumping against a 150-feet head all the time—quite a record, in the author's opinion, for this class of pumping-engine. In 1903, a new well, 20 feet internal diameter, cased with cast-iron cylinders, was sunk to a depth of 35 feet; being 10 feet into chalk. Next year, a new 12¾ in. and 19 in. by 12 in. by 12 in. compound condensing engine, by Messrs. Hayward, Tyler, and Co., was put down—a duplicate of the one already mentioned, except that in the condenser the steam power is used when the river is in a state of flood or when it is below the normal level. Not having storage of any kind, they are entirely dependent upon their pumps, day and night, which is necessarily a cause of great anxiety to the man in charge.

When the Corporation purchased the works, there were about 10 miles of mains in the districts; whereas now there are 25 miles and about 22,000 consumers. Besides domestic purposes, water is used for street sprinkling and flushing in Windsor and Eton. The supply is very little used for trade, as the brewers in the district have their own wells. The water is analyzed every three months, and the reports are always excellent. There are five wells on the works; four being 8 feet and the new one 20 feet internal diameter.

CREWKERNE COUNCIL AND THE WATER SUPPLY.

It was decided, at a meeting of the Crewkerne District Council last week, that the necessary steps be taken for the promotion of a Bill for the purchase of the undertaking of the Crewkerne Water Supply Company, Limited.

The Chairman (Mr. H. Gould) said that the matter they were to discuss had been for a long time before the ratepayers, who he firmly believed had made up their minds that the water-works ought to be bought by the Council. They had no guarantee that the charges for water would not be increased; and they had a foretaste of the intentions of the Company recently in the raising of the price of water used for certain purposes. The Company had expunged the Article of Association which specified that the water supply could be acquired by the ratepayers under certain conditions at any time. When the Chard Rural District Council were suggesting the purchase of the undertaking, and before the granting of urban powers to Crewkerne, 25 per cent. was taken off the charges for water. He believed this was done to make the public less desirous of a change; and it had been said that, when the proposal to purchase had fallen through, the 25 per cent. would be put on again. The town ought to have charge of the water, in order to see that the supply was such that it need not be turned off as was frequently done now. Mr. F. Stoodley seconded the resolution, and said that the Company, who had a capital of £8000, paid a dividend of 2½ per cent. in the second year of their existence; and the dividends paid since had risen steadily year by year to 6 per cent. The notices to rescind the article giving the ratepayers power to purchase were issued immediately it was proposed to confer urban powers on the town; the reason given being that the proviso interfered with the sale of the shares. Mr. F. J. Tompsett proposed, as an amendment, that all action in the matter should be deferred so long as the Company did not increase the present charges for water. He said that, as a ratepayer, he was entirely against incurring the expense of buying the undertaking, especially as the charges for water were lower than those of other towns in the neighbourhood. They amounted in Crewkerne to 3¾ per cent. on the rateable value, whereas in other towns the charge was 5 per cent. The cost of compulsory purchase might be £20,000 or £25,000; and it involved the risk of their having to pay a rate of 7d. to 9d. in the pound for a number of years. They might not approve of the action taken by the Company in rescinding the purchase clause in the Articles of Association; but the Company did nothing illegal, and the ratepayers ought not to be punished because the Council did not approve of the Directors' action. The Chairman contended that the cheapness of the water, to which Mr. Tompsett referred, was due to the reduction of 25 per cent. which had been made in the charges; and he said the prices would probably be raised if the purchase scheme lapsed. If the Council waited till the charges were increased, they would have to give many thousands of pounds more for the works. The amendment was not seconded; and the resolution in favour of the promotion of a Bill was carried by six votes to one.

The Blyth District Council and Lord Ridley's Water-Works.—At the meeting of the Blyth Urban District Council last Thursday, a letter was read from the Local Government Board refusing to grant a loan asked for to purchase Lord Ridley's water-works. The Council entertain the opinion that the Board do not know the full facts of the case, and an effort will be made to explain the reasonableness of the Council's scheme to buy the works, which now serve the town, and to close them in order to get a better domestic supply from the Newcastle and Gateshead Water Company.

NOTES FROM SCOTLAND.

From Our Own Correspondent.

Saturday.

We made a start this afternoon with the work for the session of the Scottish Junior Gas Association; the Eastern District having held their third annual general meeting in Edinburgh. The attendance was good; and the report of the Council and other items of business were quite satisfactory in every respect. Mr. W. Mitchell, of Dundee, was presented with the gold medal of the District for his very practical paper, read at the December meeting of last year, upon "Retort-Settings in Relation to Carbonizing." Mr. J. Dickson, now Manager of the new gas-works at Kelty, in Fifeshire, retired from the presidentship, and was succeeded in that office by Mr. W. Brown, of Lasswade, a young man of whom it may be said that he is struggling into fame under the guiding hand of Mr. W. Young, of Peebles. Mr. Brown gave a very chatty and quite instructive address, which was discussed shortly; the chief speaker being Mr. Alex. Wilson, of Glasgow, who, an honorary member, did not fail to look in and give his countenance to the work of the Junior Section. For the session, a very nice syllabus has been drawn up, which includes quarterly meetings in Edinburgh on Nov. 17, Jan. 19, and Mar. 2, and visits to the Dundee Corporation Gas-Works on the 20th inst., to Messrs. Alder and Mackay's Meter-Works on Dec. 15, to the works of the Glenboig Union Fire Clay Company, Limited, on Feb. 2, and to the works of the Broxburn Oil Company, Limited, on March 30. It will be observed that the session ends in March. Last session was carried on till April, and the previous one till July; but on both occasions it was found that the later meetings were not so well attended as the earlier ones.

The subject of the trading of members of corporations with departments of corporations of which they are members was again under discussion in the Glasgow Town Council on Thursday. Two members submitted questions which they wished the Town Clerk to answer. Mr. Alston's question was: "In view of the advice given by the Town Clerk to the members of the Corporation not to purchase coke from the Gas Department, would he now state whether, in his opinion, it would be legal for a member of the Corporation to purchase gas-lamps or gas-stoves from the Gas Department, and have them fitted up by workmen in the pay of the Corporation; and, if it were illegal to purchase stoves and lamps, would it be equally illegal to purchase gas and water from the Corporation?" Mr. Nicol asked: "In view of the opinion expressed by the Town Clerk at last week's meeting on the subject of members of the Corporation buying coke from the Corporation department, would the Town Clerk say if that opinion applied equally to the case of a member of the Corporation purchasing fertilizer from the sewage department, or a hot bath at 4d. from the baths department?" The Town Clerk replied that he wished members of the Council to understand that in future he did not undertake, and did not agree, to answer any abstract legal question. If any specific case came before him, having reference to the ordinary business of the Town Council, he should be only too pleased to give any information in his power. The purchase of gas-lamps or gas-stoves by members of the Corporation from the Gas Department was not distinguishable, in his opinion, as a legal proposition, from the purchase of coke by a member of the Corporation from the Gas Department. The only possible point which might distinguish them would be the triviality of the transaction; and in regard to that matter, personally, if he were a member of the Corporation, he should have no difficulty, considering the legal maxim—*De minimis non curat lex*—the law does not trouble about trivialities. Mr. W. F. Anderson said the Corporation were proprietors of, roughly, £800,000 worth of house and shop properties, some of which were occupied by members of the Corporation as dwelling-houses and as business premises. As a member of the City Improvement Trust, he wanted to know whether they were in future to ask their factors not to let premises to members of the Corporation. The Town Clerk pointed out that in Scotland a member of a corporation might not lawfully lease any premises from the corporation. In England there was an exception in the case of leasehold property, but not in Scotland. The fertilizer was in the same position as coke. Mr. Dugald Campbell gave notice of a motion to the effect: "That the resolution adopted by the Town Council on Jan. 4, 1877, be rescinded, and that the Gas Committee should, after the date of the rescinding of the said resolution, report to the Corporation for confirmation all contracts for coal and other commodities purchased by them for the Gas Department, together with the names of contractors and the quantities of materials to be supplied by each of the respective contractors." It will be observed that this motion, of which notice has been given, does not cover the same grounds as the other subject. The one is the purchase of materials "from" the Corporation, and the other is purchasing "for" it. As to the former, surely the members of the Corporation have now got to understand their position. The Town Clerk has admitted that trading is not lawful, and has prohibited purchasing and leasing goods and properties, although he goes the length of saying that trivial cases might be disregarded. Now that is very elastic advice, because what would be triviality in the case of a member of the Corporation who was able to ride in a carriage and pair might not be so in the case of a working man representative. We can thus perceive how the existence of one law for the rich and another for the poor would quickly be alleged. So that, after all, "no trading" is at present the only safe ground which a member of a corporation can occupy. Perhaps we may be able to judge a little of what Mr. Campbell's reasons will be from another notice of motion which he gave, to the effect: "That the resolution of the Gas Committee of Sept. 26, 1901, to pay time-and-a-quarter for Sunday labour to the workmen at the various gas-works for work done on that day during the twelve hours from six a.m. to six p.m., be rescinded, and that from the date of the rescinding of the said resolution, all gas-workers employed in Sunday labour any time during the twenty-four hours of that day be paid time-and-a-quarter."

At the same meeting of the Council, Mr. Gray asked general approval of a proposed Provisional Order which dealt with two outstanding questions—the purchase of the undertaking of the Busby Water Company, and the unification of the lighting of streets, stairs, and courts.

The Council gave their general approval to the Order, on the understanding that clauses may be altered or deleted at a future stage.

In the Dumfries Town Council this week, the Gas Committee recommended, by a majority, that the price of gas to ordinary consumers be retained at 2s. 10d. per 1000 cubic feet, and that to prepayment meter consumers it should be reduced from 3s. 6d. to 3s. 4d.; and they unanimously recommended that for engines the price be retained at 2s. 7d. They also recommended that £1000 be placed to the reserve fund, and that the balance of profit, amounting to £1127, be carried forward. In the Council it was moved that to ordinary consumers the price be reduced to 2s. 8d., which, it was said, would cost about £800, and there would still be a considerable balance left. The proposal was also made that the price of gas should be reduced by 2d. to consumers within the burgh, but that no change be made to consumers outside. This raised the question, which has troubled the Council before, of residents in the neighbouring burgh of Maxwelltown getting the advantage of cheap gas from Dumfries, while taking none of the risk. After discussion, the proposals of the Committee were adopted.

In the North Berwick Town Council on Tuesday, on the motion of Bailie Sim, the Convener of the Gas Committee, the price of gas was reduced from 3s. 9d. to 3s. 6½d. per 1000 cubic feet.

The Banff Gaslight Company have paid a dividend at the rate of 15s. per share, and carried forward a sum of £190. They have also reduced the price of gas, for ordinary purposes, from 6s. 3d. to 6s. per 1000 feet, and for cooking, heating, and power from 5s. to 4s. 7d.

New gas-works are being erected at Polmont, by a Company who appear to be known as the Redding Gas Lighting Company. In the district to be served is the village of Laurieston, the public lighting of which is at present under consideration. On Thursday evening, a meeting of the inhabitants was held to discuss this and other matters. It was then stated that some time ago the Village Association entered into negotiation with the Corporation of Falkirk for a supply of gas, but that, some delay having taken place, the Corporation of Falkirk had not applied themselves to the subject, especially when they learned that the Redding Company were laying gas-pipes in the village. The question was asked who authorized these gas-pipes to be laid. No one present could answer; and the meeting was adjourned, to allow the representative of the district in the County Council to be communicated with.

Grave allegations regarding the quality of the water supplied to the city of Aberdeen have been made this week. The full quantity which is allowed by statute to be abstracted from the River Dee is now being taken, with the consequence that an addition to the water supply is necessary. As is well known, the Water Committee are desirous of taking in the waters of the River Avon, and of abandoning altogether the Dee as a source of supply, the water in which is contaminated by sewage from the populous places in the watershed. The full extent of the pollution has not been realized until now, when a report upon the present supply has been submitted to the Water Committee by Professor Matthew Hay, the Medical Officer of Health for the city, and Professor Hamilton. These gentlemen have found most serious contamination of the water at various points. A visitation by the Town Council to a number of places on the river as far as Braemar was made on Tuesday of this week; and the councillors are reported to have been impressed by the fact that the pollution of the river is being carried on to a dangerous extent. So alarming is the situation that a special meeting of the Town Council has been called to consider it.

CURRENT SALES OF GAS PRODUCTS.

Week ending Oct. 6.

The London market for tar products has been a little quiet during the last few days. Pitch is from 31s. 6d. to 32s. net. 60° crude carbolic is 1s. 9d. to 1s. 9½d. net. 90 per cent. benzol is 10⅜d. to 11d. with a good demand. Ordinary London creosote at 2⅜d. to 2½d. net in bulk at makers' works is much inquired for. Crystal carbolic is firm at 5⅜d. and 6d. net; but orders are a little scarce. Sulphate of ammonia is firm, but without change.

Sulphate of Ammonia. LIVERPOOL, *Oct.* 6.

September contracts being covered, demand has been less keen; but available parcels have been disposed of at last week's closing prices, there being no surplus stock to weigh upon the market. The quotations remain £11 17s. 6d. per ton f.o.b. Hull, and £12 1s. 3d. per ton f.o.b. Liverpool and Leith. Prompt prices would also be paid for October, and up to £12 2s. 6d. per ton is reported paid at Leith. The quotation for October-December remains £12 5s. per ton, and that for January-June £12 10s. per ton; but consumers do not show much keenness about operating at these prices. They seem rather inclined to magnify increasing production, and to minimize the effect of relative cheapness compared with any other nitrogenous material.

Nitrate of Soda.

This article remains very firm, and spot prices are now 11s. 10½d. per cwt. for 95 per cent., and 12s. 4½d. per cwt. for refined.

Tar Products. LONDON, *Oct.* 5.

Markets have been fairly steady during the past week; but there has been a distinct desire on the part of manufacturers on the east coast to sell pitch for prompt delivery. In more than one instance, makers have offered to accept 29s. 6d.; while without doubt some quantity could be obtained for October-March at 30s. London makers are still firm, having evidently sold a fair quantity; but there is still an absence of orders from the Continent. In South Wales, consumers have evidently bought what they require for the present, and are not now inclined to place any further contracts except at prices which will enable

CARBURETTED WATER-GAS APPARATUS

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CARBURETTED WATER-GAS ENGINEERS.

The above Company have erected since 1893, or are now erecting, their Universal Type of Carburetted Water-Gas Plant at the following Gas-Works:—

	Cub. Ft. Daily.		Cub. Ft. Daily.		Cub. Ft. Daily.
Blackburn	1,250,000	Winnipeg, Man.	500,000	Malton	150,000
Windsor St. Works, Birmingham	2,000,000	Colchester (Second Contract)	300,000	Smethwick	500,000
Saltley Works, Birmingham	2,000,000	York	750,000	Gravesend	300,000
Colchester	300,000	Rochester	500,000	Pernambuco, Brazil	125,000
Birkenhead	2,250,000	Kingston, Ont.	300,000	Duluth, (Second Contract)	300,000
Devizes	120,000	Crystal Palace District	2,000,000	Leicester (Second Contract)	1,000,000
Saltley, Birmingham (Second Contract)	2,000,000	Duluth, Minn.	300,000	Newport (Second Contract)	250,000
Windsor St., Birmingham (Second Contract)	2,000,000	Caterham	150,000	Brockville	250,000
Halifax	1,000,000	Leicester	2,000,000	Toronto (Third Contract)	750,000
Toronto	250,000	Enschede, Holland	150,000	Montreal, Ont. (Second Con.)	1,800,000
Ottawa	250,000	Buenos Ayres (River Plate Co.)	700,000	Toronto (Fourth Contract)	1,000,000
Lindsay (Remodelled)	125,000	Burnley	1,500,000	Hamilton, Ont.	400,000
Montreal	500,000	Kingston-on-Thames	1,750,000	Rochester (Third Contract)	1,600,000
Toronto (2nd Con:., Remodelled)	2,000,000	Accrington	500,000	Leeds (Second Contract)	900,000
Belleville	250,000	Tonbridge	300,000	Buenos Ayres (Primitiva Co.)	1,200,000
Ottawa (Second Contract)	250,000	Stretford	500,000	Buenos Ayres (New Co.)	1,200,000
Brantford (Remodelled)	200,000	Oldbury	300,000	Christchurch, N.Z.	300,000
St. Catherines (Remodelled)	250,000	Todmorden	500,000	Rochdale	1,600,000
Kingston, Pa.	125,000	Saltley, Birmingham (Third Contract)	2,000,000	St. John's, Newfoundland	250,000
Peterborough, Ont.	250,000	York (Second Contract)	750,000	Brantford (Second Contract)	400,000
Wilkesbarre, Pa.	750,000	Rochester (Second Contract)	500,000	Smethwick (Second Contract)	500,000
St. Catherines (Second Cont.)	250,000	Newport (Mon.)	250,000	Pontypridd	250,000
Buffalo, N.Y.	2,000,000	Tokio, Japan	1,000,000	Montreal (Third Contract)	1,800,000
		Newcastle-on-Tyne	1,800,000	Guelph, Ont.	50,000
		Leeds	1,800,000	Buenos Ayres (River Plate Co.) Second Contract	750,000
				Belgrano (River Plate Co.)	500,000

And, in addition, COAL GAS PLANTS at NELSON, B.C., CHATHAM, BERLIN, NAPANEE, OWEN SOUND CALGARY, and WINNIPEG.

them to take the pitch into stock. There is no change in creosote. London manufacturers are disinclined to sell, although one or two parcels of second-hand London oil could be obtained at about 2d. per gallon; but as regards country manufacturers, they are evidently very well sold, and not disposed to do any further business except at good prices. In the North, 1⅝d. is reported to have been paid at makers' works; while in the Midlands 1¾d. is asked. In carbolic acid, there appears to be some desire on the part of Continental consumers to buy for prompt delivery, and they now offer 1s. 9½d.; while they would probably pay 1s. 9d. for delivery over the first six months of next year. It is reported that 1s. 8⅛d. has been accepted on rails in the Midlands for delivery over this period. In crystals there is no change, and prices continue unaltered. The market for benzol still remains very firm, though Continental consumers report having purchased English stuff at low prices for delivery all over next year. London manufacturers ask 10⅛d. to 10⅜d., and have realized the former price on their works to the end of the year. In 50-90 per cent. there is very little offering; and the market continues firm, with prices unaltered. Solvent naphtha remains firm; but there is practically no change in price, though good figures are reported to have been paid for small quantities for prompt delivery. Toluol also remains as before, at about 1s. 1⅛d. on the east coast to 1s. 2d. London. Heavy naphthas are still in good demand; and it appears evident that consumers will have to pay very good prices for their next year's supplies. A contract of considerable importance for tar was let during the past week at a price equal to 18s. delivery at makers' works.

The average values during the week were: Tar, 16s. to 20s. Pitch, London, 31s. to 31s. 6d.; east coast, 29s. to 30s.; west coast, 29s. to 30s. Benzol, 90 per cent., 10⅛d. to 10⅜d.; 50-90 per cent., 11⅛d. to 1s. Toluol, 1s. 1⅛d. to 1s. 2d. Crude naphtha, 4¾d.; solvent naphtha, 1s. 2d. to 1s. 3d.; heavy naphtha, 1s. 2d. to 1s. 3d. Creosote, London, 2d. to 2¼d.; North, 1⅝d. Heavy oils, 2⅜d. Carbolic acid, 60 per cent., 1s. 9¼d. Naphthalene, £4 10s. to £9 10s.; salts, 32s. 6d. to 35s. Anthracene, "A" quality, 1½d. to 1⅝d.

Sulphate of Ammonia.

The market has been steady during the past week, with practically no change in prices. London manufacturers still quote nominally £12 2s. 6d. upon their special terms; but business could no doubt be done at £11 18s. 9d. to £12 for ordinary London makes. In Hull, there has not been much business doing. Manufacturers ask £12, but cannot realize this price; and for forward delivery they are not inclined to sell. In Liverpool, the value may be taken as £11 18s. 9d. to £12 1s. 3d., according to quality; while in Leith, makers are firm at £12 2s. 6d. for prompt, and £12 7s. 6d. to £12 10s. for forward delivery.

Sale of Shares in the Brixham Gas Company.—There were recently offered for sale at Brixham 5000 preference shares of £10 each in the Brixham Gas Company, which were all sold, and realized £5171 7s.; being an average price of £10 6s. 1d. per share.

COAL TRADE REPORTS.

Lancashire Coal Trade.

The winter's prosperity in the Lancashire coal trade has begun. The increase of 10d. per ton for all descriptions of house coal has been accepted without a murmur. What is almost sure to follow at the proper time is a rise in the prices of engine fuel. Prices have, in fact, been hardening for some time past, and more money has been got on contracts. On the other hand, slack has been scarce of late, and more difficult to buy. Now, with greater activity in house qualities, more slack will be made; and, under the law of supply and demand, it should be cheaper. The claims for gas coal and cannel are increasing. The average quotations at the pits are: Best house coal 13s. 10d. to 14s. 10d. per ton, secondary 12s. 10d. to 13s. 10d., common 9s. 10d. to 10s. 10d., steam and forge 8s. to 9s., best engine fuel, 7s. 6d. to 8s. 6d., best slack 6s. 9d. to 7s. 6d., medium 6s. to 7s., and inferior 5s. to 6s. Coal for shipping is improving at from 9s. 6d. to 10s. 6d.

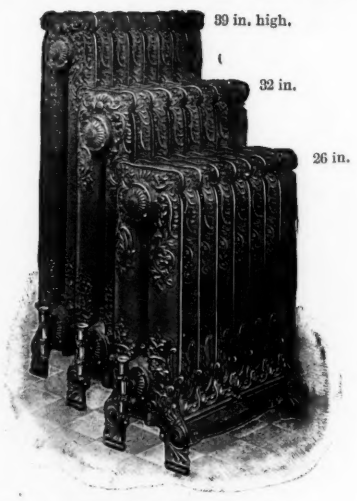
Northern Coal Trade.

There is a better request for coal, but it is barely up to the average; and, in part, this must be expected to continue until the expiration of the coal-tax allows the demand to attain its usual dimensions. There is a moderate inquiry for the best steam coal for early delivery; and the price varies from about 10s. 1½d. to 10s. 6d. per ton f.o.b. Second-class steams are 9s. 6d., and steam smalls vary from about 6s. to 6s. 6d.—the latter class being rather scarce. Work at the collieries in Northumberland is steadily carried on, with about an average output. The gas coal trade is more active; the home consumption being heavier, with a corresponding increase in the deliveries on the long contracts. There are, however, still full and ample supplies, more especially of all kinds except the very best Durham gas coals. The prices quoted vary from about 9s. 9d. to 11s. per ton f.o.b. generally; but for one or two kinds even higher prices are quoted. There have been one or two contracts for delivery into next year fixed—one for an Italian port, at a price that is said to be about 10s. per ton f.o.b.; but this figure cannot be looked upon as official. In the coke market, there is a strong demand; and this benefits gas coke, which is from 12s. 3d. to 13s. per ton f.o.b. There is, however, a larger output, so that the stocks at inland gas-works are heavier in some cases.

Scotch Coal Trade.

Trade is steady, and without change. There are very large exports; the desire being to get as much coal delivered at Northern ports before the advent of winter. Apart from that, the forward market is not strong. The prices quoted are: Ell 8s. 9d. to 9s. 9d. per ton f.o.b. Glasgow, splint 9s. 6d. to 9s. 9d., and steam 8s. 9d. to 9s. The shipments for the week amounted to 308,065 tons—an increase of 26,470 tons upon the previous week, and 66,491 tons upon the same week of last year. For year to date, the total shipments have been 10,310,403 tons—an increase of 1,151,163 tons upon the corresponding period of 1905.

ALWAYS in DEMAND



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The Public realize:—

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2. The huge saving effected.
3. The dispensing with Boiler, Steam Piping, Flue, and Attendance.

Are you prepared for the inevitable large Demand?

The New Water Supply for Teignmouth.

A start was made on Thursday last with the work of laying the pipe-line which is to convey to Teignmouth the supply of water which it is to derive from the new reservoir of the Paignton District Council. The total length of main to be laid is 10½ miles of 9-inch, ½ mile of 6-inch, and 3 miles of 4-inch. In order to supply the outlying district of Shaldon, the River Teign has to be crossed; and the pipes, which will here be duplicated, are to be laid at a depth of 3 feet below the present bed of the river, so that they may not interfere with navigation or the future dredging of the river. A meter-house is to be erected, which will contain two Venturi meters; and the existing reservoirs to which the supply will be conveyed will have special inlet-chambers and automatic recording meters. The mains will be of Mannesmann steel tubes. The total cost of the work is estimated at £19,300; and its execution will occupy eighteen months, by which time it is expected the reservoir works will be completed and the new supply of water available. Mr. W. M. Bird, the Chairman of the Teignmouth District Council, cut the first sod of the pipe-line. Speaking subsequently at a luncheon, he referred to "the splendid audacity" of Paignton in undertaking the large scheme of water supply which enabled them to share its advantages with Teignmouth. He also complimented Mr. C. F. Gettings, the Surveyor, on the success with which he had overcome the difficulties of maintaining a supply of water for the town during the past dry summer, and said it would be satisfactory to him to know that the nightmare he had suffered in consequence of the shortness of the supply of water had been dispelled, thanks to the help of Paignton. Mr. E. Westlake, Chairman of the Paignton District Council, said that that body had also met with many difficulties in connection with the supply of water; but they now hoped to get a thoroughly good supply for the higher levels of the town. Mr. Bird was presented by the Contractors with a silver-plated spade with which to inaugurate the work, and as a memento of the event.

Gas Discount in Belfast.—The question of increasing the discount to gas consumers at Belfast has more than once been discussed; but last month the Council in Committee decided that consideration of the matter should be further adjourned until next January. At last week's ordinary meeting of the Council, this course was objected to by many of the members; and as the result of a long discussion, the original recommendation of the Gas Committee increasing the present discount of 10 per cent. on gas accounts to 15 per cent. was adopted. In the course of the debate, one member challenged the Gas Committee to say what proportion of water gas was used in Belfast; and Mr. J. A. Doran, the Chairman of the Committee, at once replied that it was 41 per cent. Another member pointed out that there had been contributed from the profits of the gas undertaking since 1888 a sum of £155,418; while still another remarked that the amount involved in the proposed increase of 5 per cent. in the discount would be something like £7000 a year.

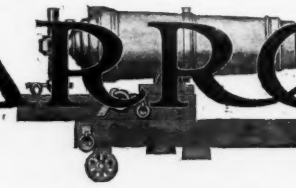
The Reinstatement of Trenches in Westminster.

The Works Committee of the Westminster City Council, in a report issued last Wednesday, stated that they had received a letter from the Gaslight and Coke Company with reference to the charges made by the Council for reinstating trenches in macadam and granite pitched roads. The Company took exception to the Council's price for reinstating macadam—viz., 3s. 6d. per square yard up to and including 5 yards, 3s. per square yard over 5 yards, and a minimum charge of 7s. for any trench. They stated that they only pay 1s. 9d. per superficial yard in other districts, with a minimum charge of 1s. 9d. They asked consideration of the question whether every trench, however small, in a macadamized road should be steam-rolled, as required by the Council's contract, and whether the minimum area could not be reduced to 1 yard instead of 2 yards. The charges made to the Company are those paid by the Council to the contractors who execute the work; and the Committee reported that they did not see their way to vary the contract as regarded the use of the steam-roller. The Company also asked consideration of the charges for laying concrete under granite pitching, which are 3s. 9d. per yard super. 6 inches thick, and 7s. per yard super. 12 inches thick. They asked that they might be charged *pro rata*, with a maximum of 18s. 6d. per cubic yard. On this point also the Committee did not see their way to advise any alteration of the existing arrangement; and the Company are to be informed accordingly.

New York Water Supply.—The average daily amount of water supplied to the boroughs of Manhattan and the Bronx, New York City, during 1905 was 316,300,000 gallons. Of this quantity, 279,700,000 gallons came from the new Croton aqueduct, 18,500,000 gallons from the old aqueduct, and 17,700,000 gallons were drawn from the Bronx and Byran drainage areas. On the basis of a population of 2,390,000 for the boroughs of Manhattan and the Bronx, the average daily consumption per head in 1905 was 133 gallons.

The Wolstanton Gas Scheme.—Steps are being taken at Wolstanton to carry into effect the new gas scheme; the Gas Committee of the Urban District Council having at their last meeting adopted a report by Messrs. Corbet Woodall and Son upon the alterations necessary to be made at the gas-works, and to the mains, &c., together with a list of tenders for the various works. Messrs. Woodall and Son's summary of proposed expenditure was as follows: New retort-bench, £298 15s.; iron building for same, £80; 6-inch main complete, £408 10s.; condenser and foundation, £50; washer and foundation (£72 and £10), £82; governor and foundation (£43 and £5), £48; 42 street lanterns, columns, and fittings complete, £138 10s.—total, £1105 15s. The Clerk (Mr. E. Hollinshead) reported that the Engineers had fixed the amount to be paid to the Chesterton Gas Company by the Council for the new stock, &c., at £104 12s. 6d. The common seal of the Council was affixed to the conveyance of the Chesterton Gas-Works, and the transfer was completed. Mr. B. R. Parkinson was appointed Clerk of the Works, to supervise the main laying, alterations, &c., at Chesterton.

CARRON



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Supplied in 8 Colours of Majolica Porcelain Enamel, and in Bronze and Armour-Bright Finishes.

Lists with your Name on free.

Carron Company,

WORKS: CARRON, STIRLINGSHIRE.

LONDON (City)—15, Upper Thames Street, E.C.; LONDON (West End)—23, Princes Street, Cavendish Square, W.; LIVERPOOL—30, Red Cross Street; MANCHESTER—24, Brazennose Street; BRISTOL—10, Victoria Street; NEWCASTLE-ON-TYNE—13, Prudhoe Street; GLASGOW—125, Buchanan Street; BIRMINGHAM—Guildhall Buildings, Stephenson Street; DUBLIN—44, Grafton Street; SOUTHAMPTON—Town Quay (The Old French Prison).

Theft of Gas-Fittings at Tottenham.

At the Middlesex Sessions, on Monday last week, William Fielder (45), a painter, and Frederick Hunt (34), a labourer, were charged with stealing a chandelier of the value of 7s. 6d., the property of the Tottenham and Edmonton Gas Company. Prisoners were found in an unoccupied house at Tottenham, where the fittings supplied by the Tottenham Gas Company for the automatic gas supply had been wrenched down and placed ready for removal. A police constable, when passing the door of the house, noticed that the panel had been broken. On entering, he discovered the prisoners hiding behind a door. A detective proved 17 convictions against Fielder, ranging from a fine of 5s. up to five years' penal servitude. He was on ticket of leave, and, according to the officer, had led Hunt astray. Hunt was bound over, and Fielder was sentenced to seven years' penal servitude. In passing sentence, Mr. Montague Sharpe remarked that he hoped to see the time when he could send such men as Fielder to a colony for such persons. What good, he asked, was he to anybody? "None whatever," we reply; and, looking at his career, as related by the officer, he merits his sentence.

New Orleans Gas-Works Injured by a Tornado.—According to a Laffan telegram, a tornado, five miles long and an eighth of a mile wide, swept over the residence and factory section of New Orleans last Friday morning, passing diagonally across the city. All the local telegraph and telephone wires are now down; the splendid new market in course of erection and five new residences close by were absolutely levelled to the ground; and the gas-works were unroofed. Two factories near the works were demolished.

Explosion in a Philadelphia Subway.—According to the New York Correspondent of the "Daily Telegraph," eight persons were killed and upwards of twenty injured by an explosion of gas which took place last Friday morning in the Philadelphia subway railway, now being constructed. Most of those killed were labourers going to their work of excavating. The site of the explosion was marked in the roadway by an immense hole, from which for several hours burning gas issued. Within a large area around the scene of the explosion windows were shattered, electric trams stopped, and traffic suspended.

Public Lighting at Devonport.—A Special Committee appointed by the Devonport Town Council two years ago to consider the question of the public lighting of the town held a meeting last week. Reports were presented by the Engineers of the gas and electricity undertakings, both of which are municipal properties, showing how the lighting could be carried out by each of these bodies and the cost of it. The Committee decided to take no action for the present. Just now the main street is lighted by electric arc lamps, and most of the other thoroughfares by gas—flat-flame burners predominating. In the suburbs to which the gas-mains have been recently extended incandescent lighting is general.

Vagaries of the Electric Light.—In the "JOURNAL" last week, we referred to a complimentary dinner given by the Directors to the staff of the Watford Gas Company to celebrate the passing of their Act of Parliament. For convenience, the workmen were entertained in two parties; and the second function was enlivened by a little performance on the part of the electric light. The poorness of the light had been remarked upon by Mr. W. T. Coles, the Vice-Chairman of the Company, who was presiding, who humorously described it as "electric want of light; and during a sketch by a member of the Watford Pierrot Troupe, the current failed altogether. Needless to say the incident caused great amusement among the company; and in the subsequent speeches there was a considerable amount of banter and chaff at the expense of the unstable illuminant.

Meter Inspectors' Wages at Salford.—At the meeting of the Salford Town Council last Wednesday, Mr. Jackson objected to a resolution of the Gas Committee proposing that the wages of the gas inspectors should begin at 18s. a week, to be increased 2s. per week per annum up to 32s., and afterwards at the rate of 1s. per week to a maximum of 35s. Mr. Jackson thought that this was against the spirit of the resolution passed some eighteen months ago, to the effect that the minimum wage of all adult able-bodied workmen should be at the rate of not less than 25s. per week. He considered that the gas inspectors ought to come within the term "workmen." Alderman Phillips, the Chairman of the Gas Committee, disagreed with this view. He said gas inspectors were not workmen in the sense implied by the resolution referred to. They had to keep books and make entries in the books of the records of the meters. They rose to a much higher salary than 25s., and had also the chance of being promoted to the position of collector. An amendment that the resolution be referred back, with an instruction that the minimum wage of 25s. be paid to all men in receipt of weekly wages was rejected by 22 votes to 13; and the proceedings of the Committee were confirmed.

We learn that nearly 2000 of the Gaslight and Coke Company's customers who use gas-cookers have availed themselves of the Company's offer, made some months ago, of free cookery lessons in their own kitchens. The Company have reason to believe that many housewives and cooks have only an imperfect knowledge of the possibilities of gas cookery and of how to get the best results with the smallest consumption of gas; and their offer of free lessons at home is open to the 300,000 users of gas-cookers in their district.

At the meeting of the Westminster City Council last Wednesday, the Works Committee reported, in connection with the high-pressure gas lighting of Parliament Street and Whitehall, that a plan had been received from the Gaslight and Coke Company of the proposed alterations in the disused lavatory under Whitehall for the accommodation of the compressor plant. They propose to remove some of the basins, &c., and construct two engine-beds in the space thus obtained; the Company undertaking to bear the cost of the work, and reinstating the fittings to the Engineer's satisfaction at the expiration of the contract. The Committee stated that they had approved of the proposal.

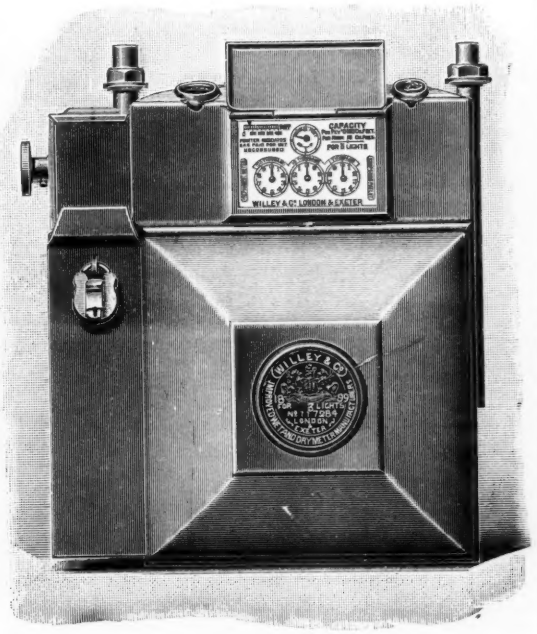
THREE POINTS

of advantage from the many found in our Slot Meters are:

1st.—They are Fraud Proof, and cannot be tampered with through the Slot.

2nd.—The Slot is closed when the maximum number of Coins have been inserted.

3rd.—Our Price-Changing System is the Simplest, Quickest, and most Accurate yet devised.



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Tens of Thousands in use, and adopted exclusively by many Gas Companies.

WILLEY & CO., LTD., LONDON & EXETER.

AGENTS FOR SCOTLAND:

D. M. NELSON & CO., 53, WATERLOO STREET, GLASGOW.

The Shoreditch Guardians have decided to replace the old coal-anges with gas-cookers; the former being regarded as obsolete.

At the last meeting of the Leek Urban District Council, a tender by Messrs. W. J. Jenkins and Co., for £1295, was accepted for a conveying plant from the railway siding of the North Staffordshire Railway Company to the gas-works.

Gas managers requiring locomotives may be reminded that Messrs Peckett and Sons, of Bristol, have them always in stock or in progress with cylinders from 8 up to 18 inches in diameter, with four and six wheels coupled. The firm give special attention to securing for their locomotives thorough fitness in all details. Their method of production enables them to turn out work to any design.

Messrs. Joseph Taylor and Co. have received orders for their latest makes of solid plate lead saturators for the Doncaster Corporation Gas Department, and the Deal and Walmer, Grays, and Wisbech Gas Companies; also for a solid plate lead saturator for a large firm of chemical manufacturers, and one, to go in connection with a coke-oven plant, fitted with plate lead well, and constructed for hand fishing, steam ejecting, or self-emptying. The firm are likewise erecting for the Tottenham and Edmonton Gas Company (as seen by the members of the Eastern Counties Gas Managers Association on the occasion of their recent visit to the works) a solid plate lead saturator on lead-lined foundations and surroundings, including drainer; mother liquor tank, lead waste-gas, ammonia, and mother liquor pipes, complete lining of sulphate stores, &c.

WANTED, FOR SALE, CONTRACT, &c., ADVERTISEMENTS IN THIS WEEK'S "JOURNAL."

Situations Vacant.

CANVASSER (Gas Company). No. 4462.
GAS MANAGER. Abergavenny Gas Department. Applications by Oct. 16.
OUTDOOR SUPERINTENDENT. No. 4664.
SUPERINTENDENT (Workshops and Out Door). Glasgow Gas Department. Applications by Oct. 15.

Pupil Required.

No. 4658.

Situations Wanted.

ASSISTANT ENGINEER OR MANAGER. No. 4661.
MANAGER (Bye Products Coke Ovens). No. 4663.
SULPHATE OF AMMONIA PLANT REPAIRER. Firgeson, Warwick Road, S.W.

Plant, &c., for Sale.

COAL GAS PLANT, COMPLETE, AND GASHOLDER. Marriage and Pinnock, Withnell Mill, near Chorley.

Plant, &c., Wanted.

STATION METER, Elland Gas-Works.

Company Meeting.

DANISH GAS COMPANY. London Agency. Oct. 30, 2.30 o'clock.

Stocks and Shares.

ALDERSHOT GAS AND WATER COMPANY. Oct. 16.
CHICHESTER GAS COMPANY. Oct. 30.
CHIGWELL, LOUGHTON, AND WOODFORD GAS COMPANY. Oct. 16.
DENBIGH WATER COMPANY. Nov. 1.
GRAYS GAS COMPANY. Oct. 30.
LOWESTOFT WATER AND GAS COMPANY. Oct. 16.
NORTHFLEET AND GREENHITHE GAS COMPANY. Oct. 16.
REDDITCH GAS COMPANY. Oct. 25.
SOUTHEND WATER COMPANY. Oct. 16.
TOTTENHAM GAS COMPANY. Oct. 22.

TENDERS FOR

Coal and Cannel.
BELFAST GAS DEPARTMENT. Tenders by Oct. 18.

Conveying Machinery and Coal Breaker.
COVENTRY GAS DEPARTMENT. Tenders by Oct. 15.

Hydraulic Plant — Tipping Machines, Lift, Capstan, &c.
COVENTRY GAS DEPARTMENT. Tenders by Oct. 15.

Steam Engines, &c.
COVENTRY GAS DEPARTMENT. Tenders by Oct. 15.

Sulphate of Ammonia Plant.
EAST DEREHAM GAS DEPARTMENT. Tenders by Nov. 6.

Tar and Liquor.
BRADFORD GAS DEPARTMENT. Tenders by Oct. 17.
HAVERFORDWEST TOWN COUNCIL. Tenders by Oct. 15.
STAINES AND EGHAM GAS COMPANY. Tenders by Oct. 29.

NOTICES TO CORRESPONDENTS, ADVERTISERS, AND SUBSCRIBERS.

No notice can be taken of anonymous communications. Whatever is intended for insertion in the "JOURNAL" must be authenticated by the name and address of the writer; not necessarily for publication, but as a proof of good faith.

COPY FOR ADVERTISEMENTS for the "JOURNAL" should be received at the Office NOT LATER than TWELVE O'CLOCK NOON ON MONDAY, to ensure insertion in the following day's issue.

Orders for Alterations in, or stoppages of, PERMANENT ADVERTISEMENTS should be received by the FIRST POST on SATURDAY.

Wanted, For Sale, and Tender Advertisements, Six Lines and under, 3s.; each additional Line, 6d.

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Telegrams: "GASKING, LONDON." Telephone: P.O. 1571a Central.

GAS COMPANIES' STOCK AND SHARE LIST.

Referred to on p. 89.

Issue.	Share.	When ex-Dividend.	Dividend or Dividend & Bonus.	NAME.	Closing Prices.	Rise or Fall in Wk.	Yield upon Investment.
£			p.c.				£ s. d.
590,000	10	Apl. 11	10½	Alliance & Dublin 10 p.c.	21—22	..	4 15 5
245,112	10	,,	7½	Do. 7 p.c.	14½—15½	..	4 16 9
200,000	5	May 11	7	Bomb'ay, Ltd.. . . .	6¾—7¼	..	4 16 7
40,000	5	,,	7	Do. New, £4 paid	5—5⅛	..	5 1 10
50,000	10	Aug. 30	14	Bourne- 10 p.c. . .	28—29	..	4 16 7
51,810	10	,,	7	mouth Gas B 7 p.c. .	16¾—17¼	..	4 1 3
53,200	10	,,	6	and Water Pref. 6 p.c.	15⅜—16½	..	3 12 9
380,000	Stk.	Aug. 15	12½	Brentford Consolidated	260—265	..	4 14 4
300,000	,,	,,	9⅜	Do. New . . .	198—203	..	4 13 7
50,000	,,	,,	5	Do. 5 p.c. Pref. .	120—125	..	4 0 0
206,250	,,	June 14	4	Do. 4 p.c. Deb. .	103—106	..	3 15 6
220,000	Stk.	Sept. 27	11½	Brighton & Hove Orig.	230—235*	..	4 15 8
246,320	,,	,,	8½	Do. A. Ord. Stk. .	163—168*	..	4 18 3
460,000	20	Sept. 27	10	British	40¾—41¼*	..	4 16 5
104,000	Stk.	Aug. 15	6	Bromley, Ord. 5 p.c. .	119—123	..	4 17 7
165,700	,,	,,	4⅜	Do. do. 3½ p.c. .	90—93	..	4 16 9
500,000	10	May 11	7	Buenos Ayres (New) Ltd.	12⅜—12⅝	..	5 9 10
250,000	Stk.	June 28	4	Do. 4 p.c. Deb. .	96—98	..	4 1 8
150,000	20	July 12	8½	Cagliari, Ltd.	24—26	..	6 6 11
100,000	10	Sept. 27	10	Cape Town & Dis., Ltd.	14¼—15½*	..	6 9 0
100,000	10	Apl. 26	4½	Do. 4½ p.c Pref.. .	9⅞—10¼	..	4 7 10
50,000	50	May 2	6	Do. 6 p.c. 1st Mort.	52—54	..	5 11 1
50,000	Stk.	June 28	4½	Do. 4½ p.c. Deb. Stk.	98—100	..	4 10 0
1,443,280	Stk.	Aug. 30	5⅛	Commercial 4 p.c Stk. .	113—115	..	4 10 5
560,000	,,	,,	5	Do. 3½ p.c. do. .	110—112	..	4 9 3
475,000	,,	June 14	3	Do. 3 p.c. Deb. Stk.	84—86	..	3 9 9
800,000	Stk.	,,	6½	Continental Union, Ltd.	123—126	..	5 3 2
200,000	,,	,,	7	Do. 7 p.c. Pref.	140—145	..	4 16 7
432,070	Stk.	Aug.	5½	Derby Con. Stk. . . .	122—124	..	4 8 9
55,000	,,	July	4	Do. Deb. Stk. . . .	105—107	..	3 14 9
486,090	10	July 27	11	European, Ltd. . . .	24—25	..	4 8 0
354,060	10	,,	11	Do. £7 10s. paid	18—19	..	4 6 10
15,203,110	Stk.	Aug. 15	4⅛	Gas- 4 p.c. Ord. . .	99⅝—100½	..	4 7 7
2,600,000	,,	,,	3⅜	light 3½ p.c. max. . .	88—90	..	3 17 9
3,799,735	,,	,,	4	and 4 p.c. Con. Pref.	107—110	−1	3 12 9
4,193,975	,,	June 14	3	Coke 3 p.c. Con. Deb.	84—86	−1	3 9 9
258,740	Stk.	Sept. 13	5	Hastings & St. L. 3½ p.c.	98—103	..	4 17 1
82,500	,,	,,	6½	Do. do. 5 p.c.	118—121	..	5 7 5
70,000	10	Apl. 11	11	Hongkong & China, Ltd.	20—21	..	5 4 9
940,000	Stk.	May 11	8	Imperial Continental .	186—189	..	4 4 8
473,600	Stk.	Aug. 15	3½	Do. 3½ p.c. Deb. Red.	95—97	..	3 12 2
181,242	Stk.	Aug. 30	6	Lea Bridge Ord. 5 p.c. .	120—125	..	4 16 0

Issue.	Share.	When ex-Dividend.	Dividend or Dividend & Bonus.	NAME.	Closing Prices.	Rise or Fall in Wk.	Yield upon Investment.
£			p.c.				£ s. d.
561,000	Stk.	Aug. 30	10	Liverpool United A . .	230—232	..	4 6 2
718,100	,,	,,	7	Do. B .	167½—169½	..	4 2 7
306,083	,,	June 28	4	L'rpool Unit'd Deb. Stk.	107—109	..	3 13 5
75,000	5	June 28	5	Malta & Medn., Ltd. .	4¼—4⅝	..	5 5 3
560,000	100	Oct. 1	5	Met. of 5 p.c. Deb..	101—103*	..	4 17 1
250,000	100	,,	4½	Melbourne 4½ p.c. Deb.	100—102*	..	4 8 3
541,920	20	May 31	3½	Monte Video, Ltd. . .	11½—12½	..	5 12 0
1,675,892	Stk.	Aug. 15	4⅝	Newc'tle & G'tesh'd Con.	110—112	−½	4 2 7
406,025	Stk.	June 29	3½	Do. 3½ p.c. Deb.	98—100	..	3 10 0
15,000	10	Aug. 30	10	North Middlesex 10 p.c.	20—21	..	4 15 3
55,940	10	,,	7	Do. 7 p.c.	13½—14½	..	4 16 7
300,000	Stk.	May 11	8	Oriental, Ltd. . . .	151—154	..	5 3 11
60,000	5	Sept. 13	7	Ottoman, Ltd. . . .	5⅝—6⅞	..	5 12 0
398,490	5	Apl. 26	7	Primitiva Ord. . . .	6½—7½	..	4 16 7
796,980	5	July 27	5	Do. 5 p.c. Pref. .	5—5½	..	4 15 3
488,900	100	June 1	4	Do. 4 p.c. Deb. .	97—99	..	4 0 10
851,070	10	Apl. 26	7	River Plate Ord. . . .	12⅝—13¼	−¼	5 5 8
300,000	Stk.	June 28	4	Do. 4 p.c. Deb. .	96—98	..	4 1 8
250,000	10	Sept. 27	8	San Paulo, Ltd. . . .	14—14½*	..	5 10 4
70,000	50	July 2	5	Do. 5 p.c. Deb. .	49—51	..	4 18 0
135,000	Stk.	Sept. 13	10	Sheffield A	241—243	..	4 2 4
209,984	,,	,,	10	Do. B	241—243	..	4 2 4
523,500	,,	,,	10	Do. C	241—243	..	4 2 4
70,000	10	May 31	10	South African	16—17	..	5 17 8
6,350,000	Stk.	Aug. 15	5½	South Met., 4 p.c. Ord.	132—134	..	4 2 1
1,895,445	,,	July 12	3	Do. 3 p.c. Deb.	86—88	..	3 8 2
575,000	Stk.	Aug. 15	5½	S'th Suburb'n Ord. 5 p.c.	123—126	..	4 7 4
60,000	,,	,,	5	Do. 5 p.c. Pref. .	123—126	..	3 19 4
112,533	,,	July 12	5	Do. 5 p.c. Deb. Stk.	128—133	..	3 15 2
502,310	Stk.	May 11	5	Southampton Ord. . .	107—112	..	4 9 3
120,000	Stk.	Aug. 30	6½	Tottenham A 5 p.c. .	125—130	..	5 0 0
388,020	,,	,,	5	and B 3½ p.c. .	103—105	+2½	4 15 3
137,500	,,	June 28	4	Edmonton 4 p.c. Deb.	103—105	..	3 16 2
182,380	10	June 14	8	Tuscan, Ltd.	10½—11	..	7 5 6
149,900	10	July 2	5	Do. 5 p.c. Deb. Red.	104—106	..	4 14 4
30,000	Stk.	Aug. 15	8	Wands- A 5 p.c. . .	—	..	—
255,636	,,	,,	6½	worth B 3½ p.c. . .	137—142	..	4 11 7
75,000	,,	,,	5⅝	and C 3½ p.c. . .	113—115	..	4 17 5
79,416	,,	June 28	3	Putney 3 p.c. Deb. Stk.	82—85	..	3 10 7
779,875	,,	Aug. 15	5⅛	West Ham 5 p.c. Ord. .	104—106	−1	4 16 6
185,000	,,	,,	5	Do. 5 p.c. Pref. . .	120—123	..	4 1 4
193,300	,,	June 28	4	Do. 4 p.c. Deb. Stk.	103—106	..	3 15 6

Prices marked * are "Ex div.